SELECTRONIC

Instruction Manual for SP PRO Interactive Inverter Charger

Operation • Installation • SP LINK • Service

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Thank you for purchasing a Selectronic SP PRO series sine wave Interactive Inverter Charger.

Selectronic has an accredited Quality Assurance system to AS/ISO9001-2008 covering both their manufacturing and design operations with over 25 years experience designing power conversion equipment for both domestic and industrial purposes.

As a result Selectronic has had many opportunities to listen to both integrators and system owners to determine their real needs.
We have learnt from our customers that:

- Modern systems need to do more than provide power and control a generator.
- Inverters should be flexible enough to "multi task" i.e. the same inverter should be able to run a remote area home, be suitable for mobile applications and be able to support the mains grid and export power to the mains grid when it is surplus to requirements.
- Complexity should be a matter of choice. The inverter should be able to perform with the minimum of configuration but still be capable of integration into the most advanced energy system.
- Battery longevity is paramount. A combination of battery protection and the best charging parameters are essential.
- Monitoring / configuration software should be user friendly with intuitive "at a glance" menu clarity.

The SP PRO has been designed with these, and many other criteria in mind.
In addition to power conversion the SP PRO can control, by time or power levels, water pumping, equipment switching, scheduled events and even – with appropriate sensors – determine if your soil in the garden is too dry and switch on a watering system. The possibilities are endless; Your SP PRO is a complete Energy System.

The SP PRO is a remote area power supply in off grid areas, a mobile power supply in boats and mobile homes and gird support in a solar hybrid system. All at the selection of one program option.

Through a set of default parameters the SP PRO can simply be "hung on the wall" and work well or have any of the many parameters individually adjusted.

Those same default parameters provide safe and efficient charging for most common batteries along with provision to adjust for your individual battery pack.

SP LINK software program provided with the SP PRO has been designed with the user in mind. No need to sift through menu chains – if you want to change a parameter relating to your batteries click on "Battery". If you want generator control click on "Generator". Why was it ever difficult?

If you have any comments about this document or your new SP PRO, please do not hesitate to contact us via our web site www.selectronic.com.au.

We trust you will get many years of trouble free operation from your SP PRO.

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Contents

OPERATION

Australian/New Zealand Warranty 6
Using This Manual 6
Included in this package 7
Benefits of SP LINK 7
Glossary of Terms 7

Precautions and Safety 8
Who should install this unit 8
Multiple Hazardous Energy Sources 8
Preparation 9
Installation 9
Maintenance 9
Inverter or Generator may start automatically 9
Battery 9

SP PRO System Integration 10
Solar Hybrid Support and Grid Feed Systems 10
Off Grid Stand Alone Power Systems (SPS) 11
Mobile Systems 12
Battery Sizing 12
Generator Sizing 13
Multi Phase configurations 13

Controls and Indicators 14
User Interface 14

SP PRO Operation 16
Battery Management 16
Battery State of Charge (SoC) monitoring and control 17
Battery Voltage monitoring and control 17
Battery Charging Operation 18
Battery Charging Cycle 19
Battery Temperature 20
Renewable Management 20
Automatic Generator Control 21
Generator Control based on SoC 21
Generator Control based on Battery Voltage 22
Generator Automatic Stopping 22
Generator Scheduling 23
Manual Generator Control 23
Remote Run Input 24
Generator Fault Recovery 24
Operating Without the Generator 24
Inverter External Alarm 24
Environmental Considerations 25
Effects of altitude on the SP PRO 25

SP PRO Communications 26
Port 1 Setup 26
Port 2 Setup 27
SP SYNC Setup 27
SP PRO Modem Initialisation 27

INSTALLATION

Installing for PRO Performance 28
- Preparation 28
- Residual Current Device (RCD) Type Recommendation 29
- Solar Hybrid (On-Grid) Preparation 29
- Off Grid Preparation 30
- Mobile Preparation 30
- Multi Phase Preparation 30
- Battery Wiring Preparation 31

Installation of SPMC models 32
- Battery Cabling Requirements 34
- Fusing 34
- DC Wiring 35
- AC Wiring 35
- Earth Wiring 35
- SPMC1201 Expansion Card Warning 36
- Current Shunt Wiring 36
- Battery Temperature Sensor 36
- Generator Control Wiring 37
- Serial Port Connection 37
- Gland Plate Fitout 37
- Initial Start up Procedure 37
- Labelling 37

Installation of SPLC models 38
- Battery Cabling Requirements 40
- Fusing 40
- Primary DC Terminal Connections 40
- DC Wiring 41
- AC Wiring 41
- Earth Wiring 41
- Expansion Card Warning 42
- Current Shunt Wiring 42
- Battery Temperature Sensor 42
- Generator Control Wiring 42
- Serial Port Connection 43
- Gland Plate Fitout 43
- Initial Start up Procedure 43
- Labelling 43

SP LINK

Using SP LINK 44
- Overview 44
- System Requirements for SP LINK 44
- SP PRO Firmware Version 7.0 onwards 45
- Getting Started with SP LINK 45
- HELP! 45
- Preparing a new site 46
- Saving a new site 47
- Preparing a new configuration 48
- Saving a new configuration 50
- Connecting to your SP PRO 50
- Configuring your SP PRO 51

SERVICE

Service and Maintenance 52
- If fan filter cleaning is required: 52
- Monitoring the Operation of your SP PRO 52
- Maintenance of your SP PRO 53
- Changing Configuration Settings 53
- Restoring to Factory Default settings 54
- System Shutdown 54
- Operating When the Generator is offline 55
- Installer Maintenance 55
- System Maintenance 55

Troubleshooting 56
- Service and Support 56
- General 57
- Off Grid Generator Start/Stop Problems 57
- Inverter Start/Shutdown Problems 58
- AC Power Problems 58
- Battery Problems 59
- Solar Hybrid (On Grid) Problems 59

Appendix A Specifications 60
- Standards Compliance 60
- Product Specifications 60

Australian/New Zealand Warranty

Your Selectronic SP PRO product is warranted by the manufacturer to the original purchaser only. The manufacturer will bear the cost of parts and labour to repair any faults found within the terms and period of this warranty. For full warranty terms and conditions please see the warranty card packed with your SP PRO inverter.

If you have purchased your SP PRO outside Australia or New Zealand, please see the separate warranty supplied by the authorised distributor in your country.

Maximum warranty duration is given when the SP PRO is installed by a Selectronic Accredited Integrator and warranty registration is carried out on-line at.www.selectronic.com.au

Selectronic Australia shall have no obligation as to any equipment which has been improperly installed, stored, or handled, or which has not been operated or maintained according to this manual, nor for any operating mistakes and consequences arising from them.

Using This Manual

While every attempt has been made to ensure this manual is as self explanatory and clear as possible, there are some technical issues and safety warnings that require thorough understanding. It is extremely important that you and your integrator/installer follow all of the instructions set out in this document; failure to do so may void your warranty and stop you from gaining the full benefits that this product can provide.

This manual is divided into four sections to allow fast access to relevant information. The heading on each page indicates the section.

OPERATION	Information relevant to the user and covers the day to day operation of the SP PRO as well as certain safety warnings. This section presumes the unit's installation and set up is complete and correct.
INSTALLER	Contains information relevant to the installers from unpacking the unit to configuring the settings of the SP PRO.
SP LINK	Describes the use of SP LINK software provided with your SP PRO. See the SP LINK manual (contained in the SP LINK software) for Configuration Settings and Monitoring details.
SERVICE	Provides information to service personnel in regards to preventative maintenance and troubleshooting in case of a fault.

A PDF copy of this manual may be downloaded from the Selectronic web site www.selectronic.com.au and is also included within the Help menu of the SP LINK software.

You will notice that throughout the manual these symbols will be repeated. These symbols are very important.

This symbol indicates danger. Failure to observe this warning may result in serious injury or death, loss of property or damage to the power system

This symbol is used to draw attention to information that will assist you in making full use of your system or gives notice to information which may not seem immediately apparent

Included in this package

- Mounting bracket
- Rear Outlet Mesh Cover (SPLC models only)
- Contents check list, checked and signed by Selectronic
- Know Your SP PRO display quick reference card
- Warranty card.
- Tool kit - (Hex Drive bits - T10 Torx, T20 Torx, T25 Torx, 5 mm Hex, 6 mm Hex, long extension)
- SP LINK software, this manual and helpful information packaged on USB Memory device
- USB Cable - Type B

Benefits of SP LINK

Provided with your SP PRO inverter is a free copy of the SP LINK software. Without SP LINK the SP PRO will operate with the default settings which are the SP PRO in Off Grid mode using Sealed battery voltage parameters and Automatic Generator Control based on battery voltage.

Using SP LINK software on your PC allows you to access the different operating modes of the SP PRO and adjust the configuration parameters within the SP PRO to allow you to integrate the SP PRO into your energy system.

SP LINK accesses a host of monitoring features allowing you to keep an eye on exactly what your system is doing and how it is performing.

Your PC can be connected to your SP PRO via USB, RS232 serial port or Wireless (with optional adaptor) to open the window to the full feature potential of your SP PRO Energy System

Glossary of Terms

DC Coupled system	Where the Solar is connected to the DC side of the inverter system through a Solar Controller.
AC Coupled system	Where the Solar is connected to AC Side of the inverter system via a separate Grid Tie inverter.
Solar Hybrid	A battery based system that is connected to the electricity grid
AC Source	The primary AC input that is connected to the SP PRO, e.g., Grid, Auto start Generator, Shore Power.
Site File	An SP LINK file that is set up for each SP PRO inverter to be connect to.
Configuration File	Contains all the settings to be loaded into the SP PRO. This is normally linked to a site file
Solar Array	A collection of Solar Panels.
PV	Photo voltaic solar power
State of Charge	(SoC) Referring to the battery charge condition. 100% SoC means a full battery.
Sealed Battery	A lead acid battery with no access to the electrolyte - either valve regulated or gel. No hydrogen gas discharge during normal operation.
Flooded Battery	A lead acid battery with access caps for maintaining the electrolyte - replacing water lost during recharge operations. Hydrogen gas discharged during normal recharge

Precautions and Safety

Chapter One

Who should install this unit

While the SP PRO is designed for easy installation and can be installed by any suitably qualified person, to maximize the performance of your system and tailor the configuration of the SP PRO to your specific needs we recommend you use a Selectronic Authorised Integrator. These selected professionals within the industry have been extensively trained to analyse your system requirements, design ancillary equipment and have access to specialist support within Selectronic to assist with your individual requirements.

The voltages produced within your power system are hazardous. Even though the SP PRO may derive its input from a battery, the extremely high current capability of a battery bank is hazardous. Additionally the high voltage battery banks (120V) used in the SPMC1201 and SPLC1202 are hazardous and the output and input AC voltage in all the SP PRO models is just a hazardous as grid electricity.

All AC connections and hazardous DC connections to the SP PRO must be carried out by a qualified Electrical contractor or similar, failure to do so will contravene legal requirements.

All DC wiring must be carried out by a person experienced with DC electrical circuits and must understand high current low voltage circuits. To ensure an efficient system installation, cable sizing and voltage drop must be understood and the recommendations within this manual followed.

Selectronic Australia shall have no obligation as to any equipment which has been improperly installed, stored, or handled, or which has not been operated or maintained according to this manual, nor for any operating mistakes and consequences arising from them.

This product is not to be used for Life Support equipment

Multiple Hazardous Energy Sources

Hazardous voltages and energy are generated by the SP PRO They are fed into the SP PRO by external wiring from multiple sources and may be stored in capacitors after the SP PRO is switched off and disconnected from external wiring.

Preparation

Whilst every effort has been made to pack the SP PRO in a way that will provide adequate protection, damage in transit can occur. Please carefully check the packaging and the SP PRO for signs of damage and for all components mentioned in the “Included in the Package” section of this manual.

Please report any damage or missing parts to Selectronic or your Selectronic Authorised Distributor.

Please retain the original packaging for the safest and most effective method of repackaging if required.

Installation

- The SP PRO requires adequate ventilation, away from hot equipment. Do not obstruct the airflow passage of the SP PRO case (top and bottom). Ensure when installed in an enclosed space that there is adequate ventilation.
- The SP PRO must be located in a place away from electrolyte and corrosive aerosols.
- The SP PRO contains arcing contacts so must not be located near explosive gas mixtures such as hydrogen from batteries or diesel fumes.

Maintenance

Ensure that all energy sources are isolated before working on connected wiring. The generator may start or power may be restored by the SP PRO at any time. Never work on equipment or investigate a problem without following appropriate safety isolation procedures.

Inverter or Generator may start automatically

The SP PRO automatically starts and/or restarts and may restore power or start the generator at any time. If a fault or overload is detected the SP PRO will shutdown and may automatically attempt to restart at varying intervals of up to several hours.

Battery

Batteries are very dangerous. Please read the safety information provided by the battery supplier.

- Battery acid is dangerous.
- Batteries can emit hydrogen gas, which is explosive.
- Batteries connected in series can produce hazardous voltages.
- Disconnecting a DC power connection (even on one battery cell) can cause dangerous high-energy DC arcs, which can cause serious burns and eject hot particles, and can be difficult to extinguish.
- Disconnecting a DC power connection (even on one battery cell) can cause renewable sources to produce large voltages (much larger than the battery voltage) on battery terminals and DC wiring. Such voltages can be lethal. They can also damage the SP PRO. Only suitably trained and qualified personnel should disconnect any DC power connection, including battery cell connections, and only with suitable procedures and safety precautions.
- System battery voltages of 60 V or greater are to be treated as a hazardous voltage.

SP PRO System Integration

Chapter Two

Your SP PRO Sine wave Interactive Inverter Charger can be used in a number of different applications including Solar Hybrid (grid support / grid feed) systems, Off grid systems (SPS - where no mains grid is available) or in mobile applications such as motor homes and boats.

Solar Hybrid Support and Grid Feed Systems

In Solar Hybrid, the renewable energy can be directed to power the AC load, recharge the battery bank and/or export to the grid. The direction and priority of the energy flow can be varied dependant on the time of day, battery SoC or load demands allowing the maximum use of the renewable energy (such as PV solar) whilst taking advantage of variable electricity tariffs. A Solar Hybrid system will allow you to only use grid electricity when you choose.

By using the optional “Grid fail - Gen backup” module your SP PRO can be configured to automatically start and stop a generator during a prolonged power outage. When the generator is running, the SP PRO will use the generator to power the site load plus use any additional generator capacity to charge the batteries.

Off Grid Stand Alone Power Systems (SPS)

The SP PRO is the heart of your power system. It quietly provides AC power from the battery bank and renewable sources. By using SP LINK the SP PRO can be configured to monitor battery state of charge and load conditions to automatically start and stop the generator as required to charge the batteries and supply loads heavier than the SP PRO can efficiently handle. These features, when correctly configured, will increase your battery life and reduce your generator running costs.

When the generator is running, the SP PRO will use the generator to power the site load; plus use any additional generator capacity to charge the batteries. When the site loads are greater than the generators output, the SP PRO will add its power to the generator. When the site loads are reduced, the SP PRO will return to battery charging. The above operation happens automatically, whilst always maintaining “no break” power to the site.

The SP PRO charges the batteries in five stages (Initial, Bulk, Absorb, Float and Equalise) to ensure maximum energy is returned to the battery bank in the shortest possible time. The SP PRO will periodically perform an equalise charge after the completion of the normal charge cycle to keep the battery bank in good condition.

The charging parameters are automatically compensated by the battery temperature. It is important that the included battery temperature sensor be fitted to the battery bank and that the temperature is reading correctly for the most accurate and safe battery charging.

The SP PRO can supply short-term peak power much larger than its continuous load rating to start loads with a high peak starting demand for example water pumps and welding machines.

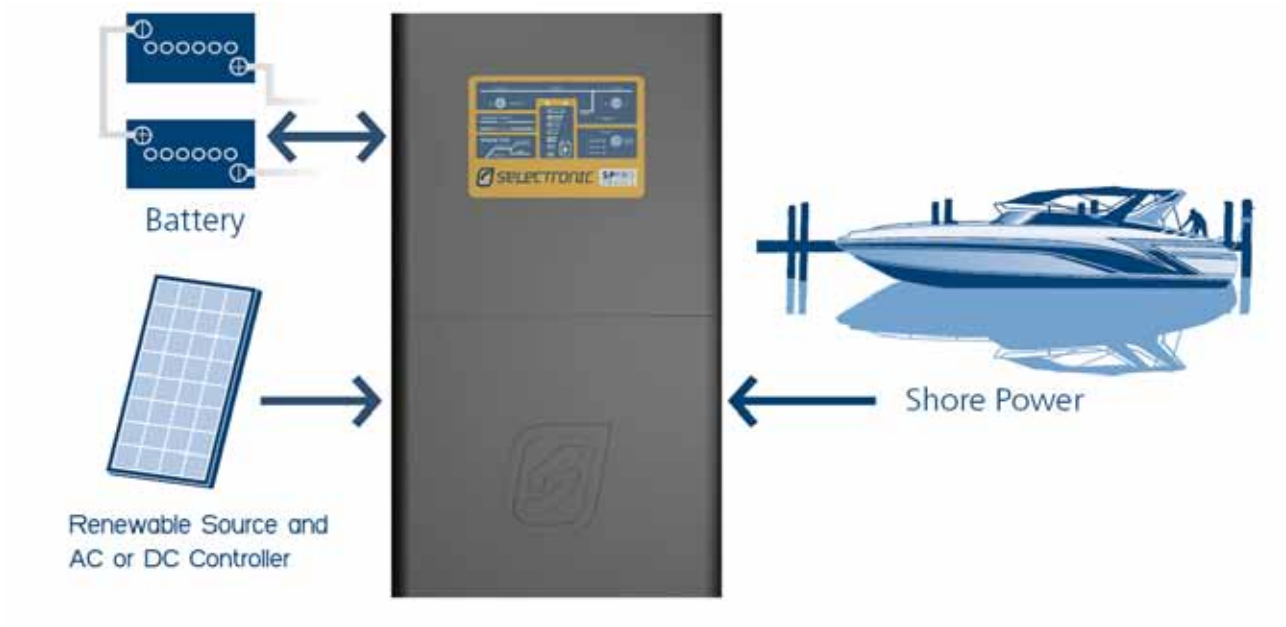
To minimize battery drain at very low load, the SP PRO can be configured to go into Power Save mode (SPMC240, SPMC241, SPMC481 and SPMC482 models only). The SP PRO will automatically switch to and from Power Save mode when the unit senses sufficient AC load.

The SP PRO has provision for two current shunts to monitor DC renewable power sources and DC loads connected to the battery bank. This allows the SP PRO to account for all DC sources and loads ensuring the batteries are correctly charged. The SP PRO measures its own DC current internally.

A KACO / SP PRO managed AC Coupled system is suitable for Off Grid systems due to the superior battery charging functions that are achieved by a sophisticated system control and monitoring communications link between the SP PRO and KACO units.

Mobile Systems

The SP PRO can support either an on board generator (Primary AC Source) or shore power(Alternate AC Source). Both input power levels can be configured into the SP PRO and selected with an external switch.



Battery Sizing

Sufficient battery capacity is imperative for optimum operation of your system. Working out the correct battery pack size that will suit your needs involves a number of factors including the daily discharge required for your system. A rough “rule of thumb” is to start with the expected daily energy required from your battery bank (in kilowatt hours or kWh) and multiple this by 1000. Divide the result by the nominal system voltage to determine the required usable Battery Amp Hours. This is then divided by the daily percentage (%) discharge you wish to take from your battery.

Example 1 - Off Grid Stand Alone

In this example the daily energy is 5 kWh per day, the system battery voltage is 48 V and the daily battery discharge is 20% (to allow cloudy days).

$$\frac{5 \times 1000}{48 \times 20\%} = 5000/48/0.2 = 520 \text{ amp hours battery capacity is required}$$

Example 2- Solar hybrid tariff optimization

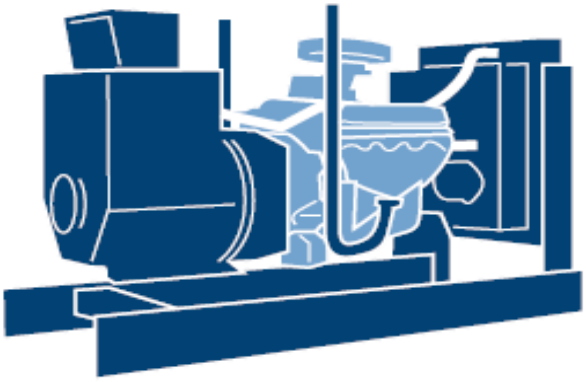
In this example the daily energy is 12 kWh per day, the system battery voltage is 48 V and the daily battery discharge is 50% (daily recharge from Solar and off peak power).

$$\frac{12 \times 1000}{48 \times 50\%} = 12000/48/0.5 = 500 \text{ amp hours battery capacity is required}$$

Generator Sizing

Your SP PRO can be configured to accommodate almost any size of generator; however a generator that is either too small or too large for the system may result in inefficient operation and a higher running cost. A well sized, good quality generator will supply all your normal loads and have enough in reserve to use the capacity of your SP PRO to charge batteries. Remember that when the generator is running the quality of power produced by the generator will be feeding through to your AC Loads.

EXAMPLE
If your usual load is around 2 kW and you are using a SP PRO SPMC481, a generator capable of providing 8 kW (10 kVA at 0.8 power factor) would be an appropriate choice. Your Selectronic Authorised Integrator will be able to advise you in this matter.



Multi Phase configurations

By combining multiple SP PRO inverters into the power system, configurations to suit either dual phase (using 2 SP PRO inverters) or three phase (using 3 SP PRO inverters) can be realised. Multi phase configurations are suitable for both Solar Hybrid (grid connected) or Off Grid applications.

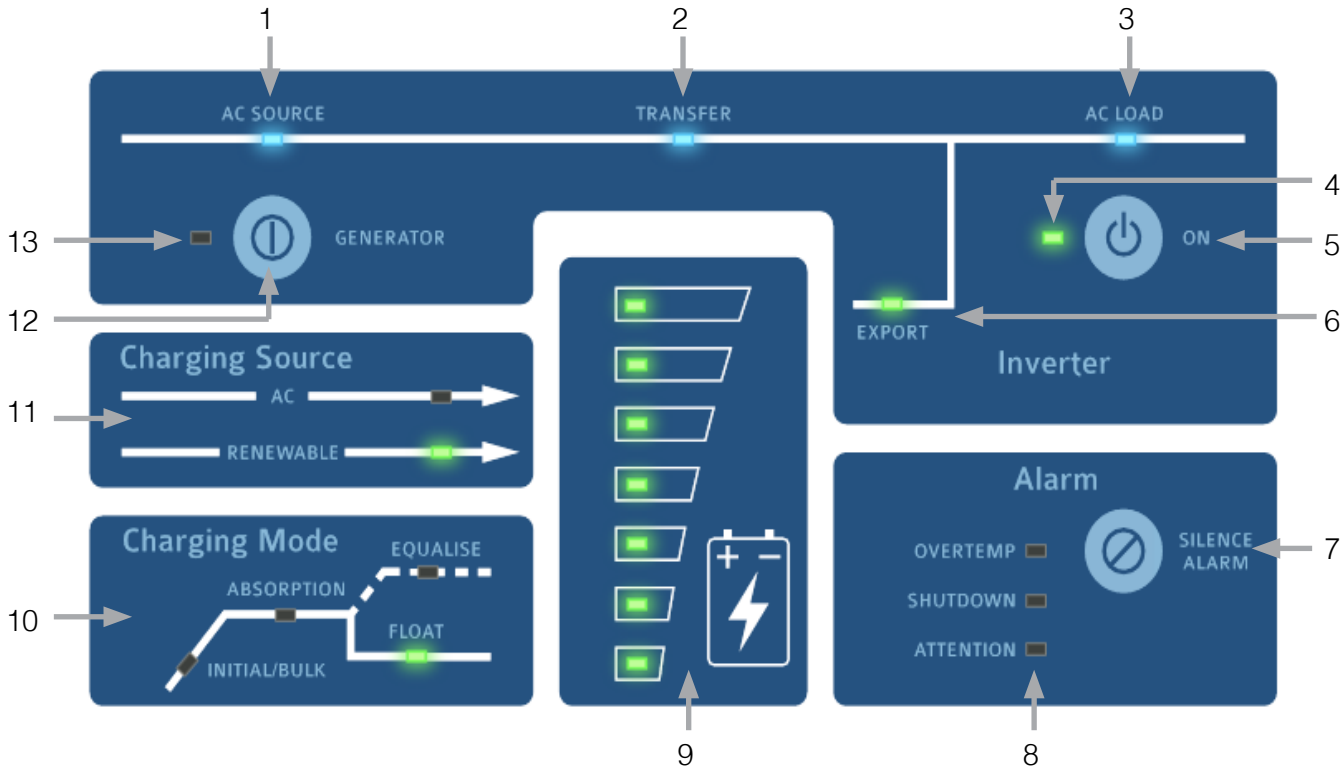
Dual phase configurations are used in power systems supplied by 480V split phase power normally used on SWER (Single Wire, Earth Return) lines.

Three phase configurations are suitable for use in power systems supplied by standard three phase power.

For more information refer to the document “IN0016_xx 004573 SP PRO 3 Phase Installation” found on the USB stick supplied with this inverter or visit the support page on the Selectronic web found site at www.selectronic.com.au.

Controls and Indicators

Chapter Three



User Interface

The following page is a list of the SP PRO control and indicators which correspond to the labelled image above.

1 AC SOURCE *

When illuminated,this shows the presence of AC supply voltage from either a motor generator or the mains grid, whichever is applicable. This is powered directly from the incoming AC supply.

2 TRANSFER *

Illuminated when an external AC supply is connected through to the AC LOAD output. If AC SOURCE is illuminated but not TRANSFER, it would generally indicate that the AC supply is out of sync tolerance – either the voltage or the frequency is beyond the set limits. If the AC supply is a motor generator, check if it needs servicing; if the mains grid, check with your supplier for a problem, or for either, that the set limits are suitable. It is normal operation for this to flicker slightly.

3 AC LOAD *

When illuminated, this shows the presence of AC voltage ready to supply loads. This is powered directly from the inverter AC output or AC supply.

* These indicators will operate without any DC connection to the SP PRO. An external AC supply will activate the AC bypass and illuminate these indicators.

4 OUTPUT MODE STATUS

Off	SP PRO is disconnected from Battery supply. AC bypass only.
Slow flashing Yellow	SP PRO is Idle (off) - Monitoring and logging but no inverter AC output.
Steady Green	The SP PRO is On.
Slow Flashing Green	SP PRO Econo mode is active and is sensing load conditions.
Fast Flashing Green	SP PRO is preparing to start.
Steady Red	Indicates that a Fault has been detected and no inverter output is possible.
Flashing Red	Indicates an open circuit or poor battery connection and no inverter output is possible.

5 ON BUTTON

A LONG PRESS (>1 second) - turns the SP PRO On, another long press SP PRO reverts to Idle.
A SHORT PRESS (<1 second) - activates Econo mode.

6 EXPORT

In grid connected systems, indicates that the SP PRO is feeding power: On, renewable exporting to the grid and supply AC Load; Flashing, supplying the AC Load.

7 SILENCE ALARM BUTTON

The Silence Alarm button cancels any audible alarm. This does not remove the alarm, just the audible component.

8 ALARM INDICATORS

OVERTEMP

Yellow	SP PRO is approaching an over temperature situation
Red	SP PRO has shutdown due to an over temperature situation

SHUTDOWN

Yellow	SP PRO is approaching a shutdown situation
Red	SP PRO has shutdown

ATTENTION

Off	Normal
Yellow	Attention Required Fan Service Request
Flashing Yellow	Clean Fan or Fan Fault Capacitor Service Request
Red	Immediate Attention required
Flashing RED	Unit Fault

See Attention Required in SP LINK Data View - Now section to determine specific reason for the attention indicator.

9 BATTERY "FUEL" GAUGE

These represent either the battery voltage or State of Charge (SoC). By default, battery voltage is indicated. All indicators on green indicate Float or higher voltage. If just the bottom indicator is on red, battery voltage is approaching the SP PRO Shutdown voltage.

If your SP PRO has SoC Control enabled, these will represent the percentage of usable charge remaining in the batteries. Usable charge is defined from 100% SoC down to the Shutdown SoC parameter.

Top Indicator	
Flashing RED	Instant Hi DC Voltage Shutdown
Bottom Indicator	
Yellow	Low Battery
Red	Low Battery Shutdown
Flashing RED	Instant Low DC Voltage Shutdown

When all are flashing RED, inverter is in Low DC Shutdown Override. In emergency situations, this override enables the SP PRO to be forced to work beyond the battery shutdown limits. The SP PRO will continue to operate at reduced capacity until the battery can no longer supply enough to keep the inverter and loads running. We remind you, this emergency feature may damage your batteries or connected equipment.

10 CHARGING MODE

The Charging Mode panel indicates the present charging mode being performed by either connected Charging Source, or the stage that will be started when Renewable or external AC supply becomes available.

11 CHARGING SOURCE

AC - On	External AC supply charging battery bank
Renewable - On	Monitored renewable supply is charging battery bank

DC Coupled renewable supplies must be monitored via an external current shunt(s) to activate this indicator.

12 GENERATOR START/STOP BUTTON

A brief press of this button (<1 second) will start or stop the generator..

13 GENERATOR STATUS

Off	No generator activity
Flashing Green	Generator is in the process of starting
Steady Green	Generator has started and is running
Flashing Yellow	Generator is not available for auto start
Flashing Red	There is a generator fault

SP PRO Operation

Chapter Four

The following section describes in detail the operation of the SP PRO. A good understanding of the operation of the SP PRO and its parameters will enable you to configure the SP PRO to meet the system design requirements.

The SP PRO Battery management continuously monitors the system operation. This monitoring allows the SP PRO to ensure the batteries are correctly charged to maximise system reliability. The monitoring includes any input from renewable sources (AC or DC Coupled) and any loads directly connected to the battery bank.

The SP PRO uses a five stage temperature compensated battery charging system. This system gives a high degree of flexibility so it can charge the multitude of battery types available.

Also incorporated are a number of “time of day” and “day of week” schedules. These schedules can be set to meet the cheapest electricity rates or high load demands from grid or generator.

Battery Management

Please refer to the battery manufacturer’s documentation for recommendations regarding settings for your particular battery. Inappropriate settings may have a detrimental affect on your battery life and performance.

The SP PRO provides comprehensive battery management settings and control to allow a charge regime to achieve optimal battery life.

SP PRO battery management features include:

- State of Charge monitoring and control.
- Battery terminal voltage monitoring (Battery Sense) and control.
- Charging initiated by battery state of charge and/or battery voltage.
- Five stage charge cycle: Initial, Bulk, Absorption, Float (short term and long term) and Equalise.
- Shutdown on low battery voltage, battery state of charge, or both.
- Two stage Battery Temperature compensation of charging voltage based on battery temperature.

The SP PRO may be configured to use the Grid power or to automatically start the generator when a battery charge cycle is required.

It is important that the battery manufacturer's recommendation be adhered to for ongoing monitoring and maintenance of batteries.

Battery State of Charge (SoC) monitoring and control

If you have enabled State of Charge control using SP LINK, you must ensure that all DC currents, other than the inverter current, flowing in and out of the battery are being monitored on either or both of the two current shunt inputs to the SP PRO. No current shunt is required to read the SP PROs current or any AC Coupled supply as this is read internally. The resultant battery current is monitored to track the battery SoC which is expressed as a percentage of the battery size set in the SP PRO (Battery Capacity). The accuracy of the battery SoC is limited by a number of factors including the charge and discharge efficiency of the battery bank and should only be used as an estimate.

To improve the accuracy of the battery SoC calculation, Peukert's equation is utilised to provide a more accurate discharge figure; whilst an adaptive algorithm is used to constantly update a "charge efficiency index" which is used during recharge.

In an Off Grid system, the state of charge is used to automatically start the generator and supply the load while any excess available generator capacity will charge the batteries. Different SoC levels can apply at different times of the day to ensure the generator is only used when required.

In a Solar Hybrid system, the state of charge along with time of day and load demand is used to vary the priority and direct the renewable energy to either power the AC load, recharge the battery bank and/or export to the grid. This allows for the maximum use of the renewable energy (such as PV solar) whilst taking advantage of variable electricity tariffs

Battery Voltage monitoring and control

The SP PRO measures the battery voltage both at the inverter and also directly at the battery bank using the Battery Sense wiring (if installed). Sensing the actual battery terminal voltage (using Battery Sense wiring) compensates for the effect of cable losses which, irrespective of charge or discharge currents, keeps the battery terminal voltage within set limits.

Battery voltage can be used as an alternative to SoC to automatically start the generator and begin charging the batteries. Different levels are used depending on the load on the system. When SoC control is enabled, the battery voltage start or shutdown levels are used as a backup to the SoC control and would be set so that the generator SoC control levels are reached before the battery voltage control levels.

Battery voltage is used to protect the system by shutting the unit down should the battery voltage go above or below set limits. The shutdown limits must be set to higher than the maximum charge voltage and less than the generator start limits. For the low voltage shutdown limits the SP PRO again employs different levels depending on system load. The system will always attempt to start the generator before shutting the inverter down due to low battery voltage or SoC.

Battery Charging Operation

The SP PRO charging system manages all charging sources in the power system giving priority as appropriate to the renewable energy sources. This ensures that the renewable sources are used in the most cost effective manner.

The SP PRO continuously monitors all charging sources to recharge the battery in a five-stage cycle. Each stage or Charging Mode is controlled by voltage, current and time settings. These settings are fully configurable using SP LINK and should not require changing after initial installation, unless some aspect of the battery installation changes.

Each voltage setting is battery temperature compensated. The set values displayed do not change. See Battery Temperature for details.

BATTERY CHARGING MODE.

Read the following with reference to the Battery Charging Cycle graph on the following page.

INITIAL

The SP PRO charges at the initial charging current until the battery voltage rises to the initial charge voltage, then holds this voltage for a set time before starting the Bulk stage. When in the Initial charge phase, the Initial/Bulk indicator will flash.

BULK

The SP PRO charges at the bulk charging current until the battery voltage rises to the bulk charge voltage, then holds this voltage for a set length of time, before starting the Absorption stage. In Bulk charge mode, the Initial/Bulk indicator will be steady ON.

ABSORB

In the Absorption charge phase the SP PRO will charge at the absorb charge current until the absorb charge voltage is reached. Once this voltage is reached, the SP PRO will carefully monitor the rate of change of the charge current as set in the Absorb-Float transition setting.
When the Absorb-Float transition setting is met, the charge cycle will switch to Float and terminate an auto start generator if connected. If an Equalise charge is pending, the Equalise charge cycle will now be performed. The Absorption indicator will be steady on when in the Absorption phase.

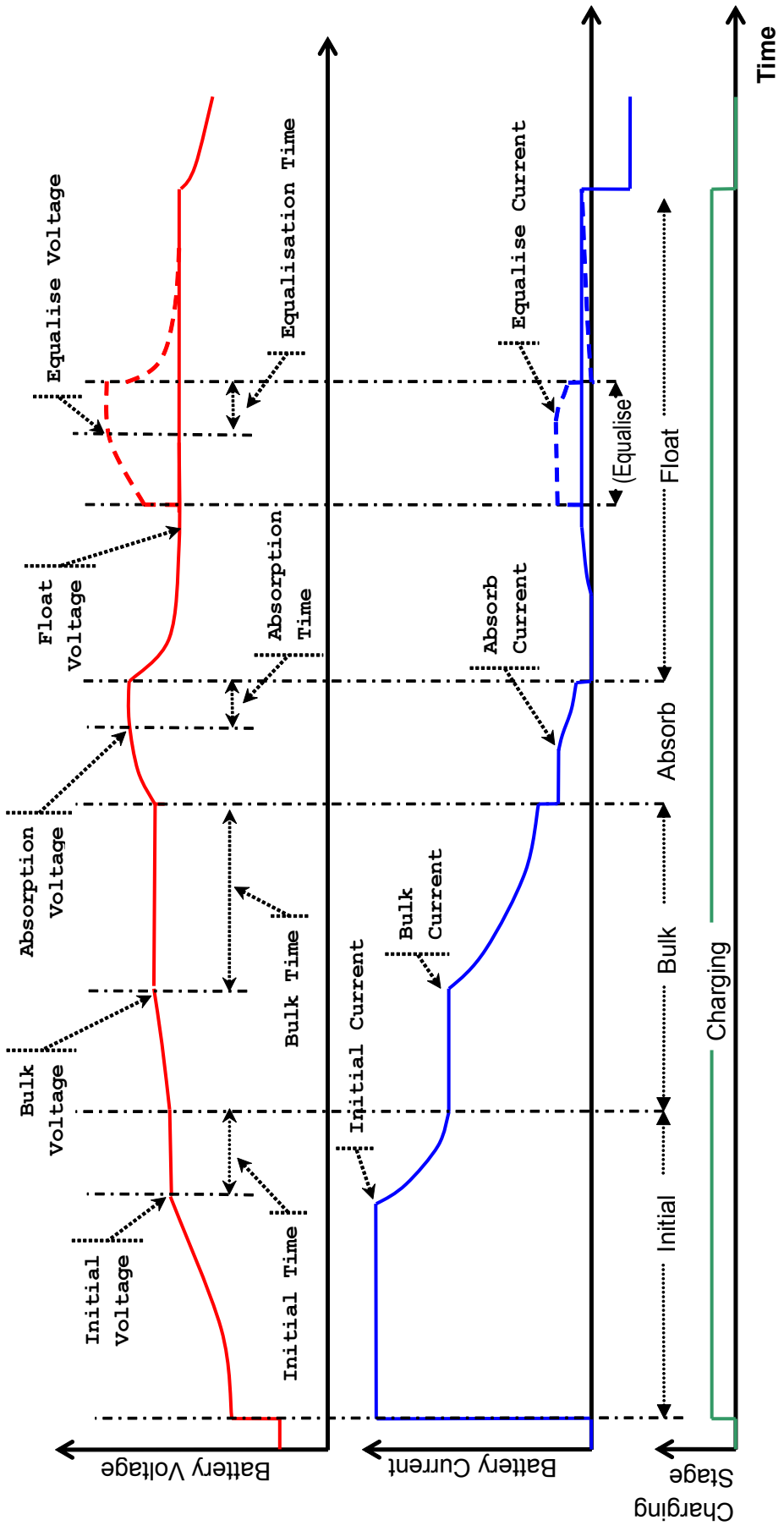
FLOAT

The SP PRO holds the battery voltage at the Float level and will provide up to the float current to maintain the float voltage. The SP PRO will remain in this charge state until battery voltage falls below the Initial Return level. If the SP PRO is still connected to an AC Source after 24 hours of Float, the charger will transition to the Long Term Float voltage. Long Term float voltage will allow batteries to sit at a lower voltage level indefinitely, reducing battery losses.

EQUALISE

Periodically, the SP PRO performs an equalise charge in which the battery is held at a higher voltage for a period set in the EQUALISE window. This will help ensure all cells within the battery bank have an equal amount of charge.

The equalise indicator will be steady on when in equalise mode and will flash when an equalise is pending, that is the charger will perform an equalise after float stage is next reached.


Battery Charging Cycle
Time
Charging Stage
Battery Voltage
Battery Current
Charging
Bulk
Absorb
Float
(Equalise
Initial
Equalise Voltage
Equalisation Time
Float Voltage
Absorption Time
Absorption Voltage
Bulk Time
Bulk Voltage
Initial Voltage
Initial Time
Equalise Current
Absorb Current
Bulk Current
Initial Current

Battery Temperature

The SP PRO monitors the battery temperature via the sensor provided. The supplied battery temperature sensor must be mounted in thermal contact with the centre of the side of the battery. If the sensor is not in thermal contact with the battery bank the batteries will not be correctly charged. Check battery temperature is reading correctly in the Temperature Control section of Technical Data in SP LINK.

The charge voltage set points are compensated by battery temperature. The default compensation applied is -5.5 mV/°C/cell with zero compensation at 25°C.

e.g. Initial Voltage = 55.2, Battery Temperature = 26°C, No. Battery Cells = 24.
Compensated Charge voltage = 55.2 + ((26 - 25) x -0.0055 x 24)
= 55.07
Absorption Voltage = 57.6, Battery Temperature = 6°C, No. Battery Cells = 24.
Compensated Charge voltage = 57.6 + ((6 - 25) x -0.0055 x 24)
= 60.11

During all charge stages, the compensated charge voltage will not exceed Max Voltage Limit. Compensation improves battery performance by preventing over or undercharging the battery and protects against battery overheating.

The charge current is also limited by battery temperature. Battery temperatures above 45°C cause the battery charger to reduce the charge current limit point. This will help also help protect the battery from overheating.

Renewable Management

SOLAR HYBRID APPLICATIONS
In Solar Hybrid, the renewable energy can be directed to power the AC load, recharge the battery bank and/or export to the grid. The direction and priority of the energy flow can be varied dependant on the time of day, battery SoC or load demands allowing the maximum use of the renewable energy (such as PV solar) whilst taking advantage of variable electricity tariffs.

OFF GRID APPLICATIONS
In Off Grid and Mobile applications your SP PRO feeds renewable power to the AC load, and any excess is stored in the battery for later use. If the battery is fully charged and all loads are being supplied, the excess is wasted (the renewable power is reduced or disconnected by the external regulator). Such waste can be reduced by tailoring your generator starting parameters to suit your individual site needs. See the generator control parameters in Using SP LINK.

Automatic Generator Control

The SP PRO may be configured to automatically control a generator in either an Off Grid power system or Solar Hybrid power system with generator backup (using the optional “Grid fail - Gen backup” module). The generator may be automatically started by the SP PRO as required to supply the load and charge the battery bank or be configured to allow manual control of the generator by the user. Generally automatic control of the generator is recommended for daily operation.

The generator will only run in automatic mode if your SP PRO recognises that the generator is available for automatic operation via a digital input to the SP PRO or can be permanently enabled via an installer setting.

As part of the installation, the SP PRO settings are configured to automatically run the generator to:

- Limit the depth of battery discharge, for maximum battery life.
- Deliver energy efficiently by supplying sustained large loads direct from the generator.
- Load the generator to the highest possible level while running, to efficiently convert fuel to electricity.
- Limit generator starting frequency, which would reduce its life and increase maintenance.
- Avoid noise by only starting the generator late at night for heavy loads or a deeply discharged battery.

In SP PRO Off Grid systems, the SP PRO automatically runs the generator for the following reasons:

- Battery conditions, in particular state of charge (SoC), require the generator to charge the battery
- Load conditions are such that the SP PRO ratings are exceeded or a sustained load is large enough to efficiently load up the generator hence running the generator will be the most efficient method to supply the load. For loads exceeding the generator rating the SP PRO draws power from the battery, adding its power output to that of the generator.
- Time Schedules are set to regularly run the generator at times of expected peak loads or at other convenient times
- The generator has not been run for the number of days specified in the Generator Exercise setting.
- Backup Schedules are set to run the generator in case of SP PRO shutdown to power vital equipment.

In SP PRO Solar Hybrid systems using the optional “Grid fail - Gen backup” module all of the generator control functions as specified above are available during a grid outage.

Generator Control based on SoC

The SP PRO may be configured to start the generator to charge the battery based on the battery State of Charge (SoC). This method of generator control is recommended to efficiently and reliably maintain the battery charge.

The battery SoC is estimated by the SP PRO and displayed as a percentage of the battery capacity and represented throughout this manual and in the menu system by the symbol SoC%.

A daily profile of preferred generator start times and battery charge levels may be configured to allow the SP PRO to automatically start and stop the generator. The profile provides the flexibility to accommodate for individual site characteristics such as renewable availability, usage patterns and generator noise considerations.

Several SP PRO settings are configured to divide the day into four periods:

NIGHT ASSIST:	This is a period starting, typically about 5:00 or 6:00 pm. During this period the generator is started if the battery is discharged below Start SoC% and will cease at Stop SoC%.
SOC NORMAL:	This setting applies at all times. If SoC falls below Start SoC% at any time the generator will be started and will charge until Stop SoC% or for Generator Min Runtime if Stop SoC% is reached before the minimum runtime has elapsed.

RENEWABLE ASSIST: If your system has been designed in such a fashion that the input from your renewable sources (solar, wind or other source) will always be lower than your usual daily power usage it is possible to start the day with a generator run period that will make up the shortfall. This ancillary charge is determined by Start SoC% and Stop SoC%.

RENEWABLE PREFERRED: If, due to inclement weather, the input from your renewable sources is lower than expected the generator will start at Start SoC% and will cease at Stop SoC%.
Once the charging is completed the generator will stop unless the load or schedules keep it running. The starting time for each of the periods can be set via the Generator Auto Run menus within the AC Source tab. The battery state of charge levels (Start SoC% and Stop SoC%.) are set by the installer at the time of installation.
If a Generator Lockout period is used the generator will still start if the generator lockout override On Low SoC limit is reached.

Generator Control based on Battery Voltage

The SP PRO will start the generator based on battery voltage. Normally these limits are not met as the SoC control will have already started the generator unless SoC control has been disabled.
The generator will start at any time should any of the pre-configured limits be met. Generator Control based on Battery Load

The SP PRO will automatically start and stop the generator based on the average battery power delivered to the load over the time period of the limit. Two configurable settings determine the battery power levels at which the generator will be started.

- 5 minute load - 5 minute average battery load
- 15 minute load - 15 minute average battery load

The generator will continue to run until the calculated average battery load power falls below all start limits and all other stop criteria are met. It can take several minutes for the average battery load to fall below the set limit once the loads have been removed.

Generator Automatic Stopping

The SP PRO will automatically stop the generator when it is no longer required for charging the battery or supplying the load.

If the generator is automatically started in any of the prescribed periods the SP PRO will stop it after it reaches Stop SoC% unless:

- A generator scheduled run is in progress
- The average battery load kW exceeds one of the configured start limits
- The minimum generator run time has not expired
- The remote run signal is active.

If the generator is automatically started in the Generator Lockout period, the generator will be stopped after it reaches the Generator Lockout Override Stop SoC unless:

- The minimum generator run time has not expired
- A generator scheduled run is in progress.
- The remote run signal is active.

In SP PRO Solar Hybrid systems using the optional “Grid fail - Gen backup” module the generator will automatically stop when the grid has been restored after a grid outage

Generator Scheduling

Two schedule types are available each with four configurable start and stop times.

RUN SCHEDULE	For generator running intended to accommodate day to day peak load periods. While the SoC method of generator control is recommended to efficiently and reliably maintain the battery charge, generator schedules may be used as an alternative generator control method or as an adjunct to SoC control to cater for expected loads.
UNAVAILABLE SCHEDULE	For emergency generator running intended for use when the SP PRO is in a shutdown state for an extended period due to some abnormal condition as may be the case if the SP PRO is unattended for long periods. The backup schedule will periodically run the generator to power vital appliances such as refrigerator or freezer.

SETTING SCHEDULES

Both Run Schedule and Unavailable Schedule are configured by setting up to four start times and associated Day or Days of week. For each start time a corresponding stop time must be set. If start/stop time combinations should overlap in generator run periods the generator will continue to run through both periods.

For Run Schedules, the stop time may be disabled. Disabling a stop time allows the generator to start at the scheduled time and automatically stop on completion of a battery charge cycle and/or load power requirements.

Note: Generator Schedules will override the generator minimum run time. Consider the generator manufacturer's recommendation regarding minimum run time when setting schedules.

Manual Generator Control

The generator can be manually controlled via the generator local controls.

Note: To disconnect from a generator without supply interruption, before manually stopping the generator it is advisable to open the Generator AC Circuit Breaker and wait until the SP PRO no longer indicates transfer.

After the generator is stopped, close the Generator Circuit Breaker ready for the next generator start.

Remote Run Input

The REMOTE RUN switch operates as follows:

- A switch closure longer than 0.5 seconds and shorter than 2 seconds causes the SP PRO to start the generator. Another such closure stops it, else it is stopped automatically when the battery reaches full charge and any sustained large load ceases. The switch is typically a non latching push button.
- A switch closure longer than 2 seconds causes the SP PRO to start the generator, and stop it when the switch is opened. The switch is typically a latching toggle.

Regardless of how the generator is started (manually or automatically), while the generator is running the SP PRO automatically charges the battery whenever sufficient generator power is available, and when fully charged will hold the battery in float charge.

Generator Fault Recovery

If the SP PRO fails three consecutive times to detect significant generator voltage for one minute after a generator start or, if voltage is detected but fails to synchronise for five minutes, a Generator Fault alarm will be asserted. The SP PRO will then use the following sequence of generator start attempts:

- After 15 minutes
- After 1 hour
- Daily, when any pre programmed SoC level is reached.
- When any DC low voltage limit is reached.

A Generator failed to start will be logged each time a start attempt fails.

Note: To force the SP PRO to immediately restart generator, use the Generator button on the front panel of the SP PRO to start the generator.

Operating Without the Generator

If a generator is not installed in the system then the following recommendations should be followed to conserve energy and battery life:

- Turn on Econo Mode. The SP PRO will pulse the output voltage and only supply continuous voltage when the load exceeds a defined limit. If present, renewable energy will recharge the battery.
- SWITCH OFF THE SP PRO when ever possible to reduce the load on the battery, allowing the battery to be recharged even by small renewable power.
- IF THE BATTERY BECOMES HEAVILY DISCHARGED, the SP PRO will automatically stop supplying AC power to the load, to prevent battery degradation or damage. Switching on the Low Battery Override function will restore power for a time at the expense of discharging the battery even more deeply.

Note: The SP PRO internal electronics are powered from the DC (battery) side, not from the AC (generator) side. Therefore if the battery is excessively discharged, the electronics may not be able to start up until the battery is partially recharged, from renewable power for example.

Inverter External Alarm

The SP PRO provides an alarm output which can be wired to an external alarm buzzer or light. A shutdown alarm is indicated by a continuous ON condition and an alert alarm is indicated by a slow intermittent ON/OFF condition. The SP PRO is in alarm state when shutdown or idle. The alarm relay is active in the normal or no alarm state condition (i.e. use the NC relay contacts to run an alarm buzzer or indicator). Alert conditions can be prevented from raising the alarm, via SP LINK.

Environmental Considerations

TEMPERATURE

Your SP PRO is designed for an ambient operating temperature between -20°C and 60°C, with a storage temperature range between –20°C and 70°C.

AIR FLOW

For best performance ensure nothing impedes ambient air from being drawn in the bottom of the unit and that hot exit air is vented away and doesn't recirculate into the unit. Particular attention must be paid when installed inside a cabinet or enclosure.

CLEARANCE FROM OTHER EQUIPMENT

A recommended clearance distance of 150 mm around all sides, top and bottom. Particular care must be taken when mounting near other heat producing equipment.

HUMIDITY TOLERANCE

Your SP PRO is designed to operate in a humidity range of 0 – 99% non condensing.

INGRESS OF PARTICLES

Your SP PRO has been designed to meet IP rating 43 (Protected against solid objects larger than 1.0 mm / protected against water falling as a spray at up to 60 degrees from the vertical) i.e. may be installed outside under cover and is insect and vermin resistant.

Effects of altitude on the SP PRO

Altitude (m)	Derating Factor @ 40°C
0, sea level	1.00
1000	0.95
1500	0.90
2000	0.85

The power rating of the SP PRO should be compensated for the effects of altitude by applying the appropriate derating factor. For example, at 2000 m above sea level, 6 kW x 0.85 = 5.1 kW. The altitude compensated rating is still at 40°C.

SP PRO Communications

Chapter Five

The SP PRO provides two isolated serial communications ports for monitoring and controlling the SP PRO and KACO devices. Each port has specific functions and are provisioned via different electrical interfaces dependant on the application. Only one type of electrical interface per serial port can be used at any one time.

Either port can be used to connect to SP LINK via a local PC or another communications device. The serial ports can be used to connect to SP LINK simultaneously enabling the user and the installer to communicate with the SP PRO at the same time to discuss system operation and performance.

Each unit is supplied with a suitable cable for connecting the SP PRO USB port to a Windows based PC.

Port 1 Setup

The SP PRO Port 1 is provisioned via the two external interfaces; an RS232 DB9M Serial connector and a USB Type B interface. Port 1 is also available via one internal RS232 RJ45 Serial connector. Only one interface may be connected to and used at any one time.

If one of the interfaces is being used and connection is required via another the unwanted interface must be unplugged. Otherwise both interfaces will interfere with each other and communications will not be established.

The USB port is the easiest to use and should be used for all local or Direct PC connections. The RS232 DB9M port is best used with a Bluetooth or zigbee Serial Adaptor(supplied separately) for a wireless local connections to a PC. The internal RS232 RJ45 serial is used for other hard wired serial connections such as a Serial to Ethernet adaptor for LAN and/or Internet communications.

SP PRO Port 1 by default is set to 57600 baud which provides the fastest connection and response times. This rate is automatically detected by SP LINK and would only need to be adjusted to a lower baud rate when using low signal quality remote connections.

Port 2 Setup

The SP PRO Port 2 is provisioned via two internal interfaces; an RS232 RJ45 Serial connector and and RS485 RJ45 Serial connector. Only one interface may be connected to and used at any one time. If one of the interfaces is being used and connection is required via either of the other two, the unwanted interface must be unplugged otherwise both interfaces will interfere with each other and communications will not be established.

The internal RS232 RJ45 serial is used for other hard wired serial connections such as a Modem connection or Serial to Ethernet adaptor for LAN and/or Internet communications. The internal RS485 RJ45 serial is used for the Managed KACO AC Coupling communications link.

The RS485 communications link requires termination resistors at either end of the pair of wires. By default the RS485 Termination switches are ON (located beside the RS485 connector) and can be left in this position as the SP PRO is often at one end of the wiring.

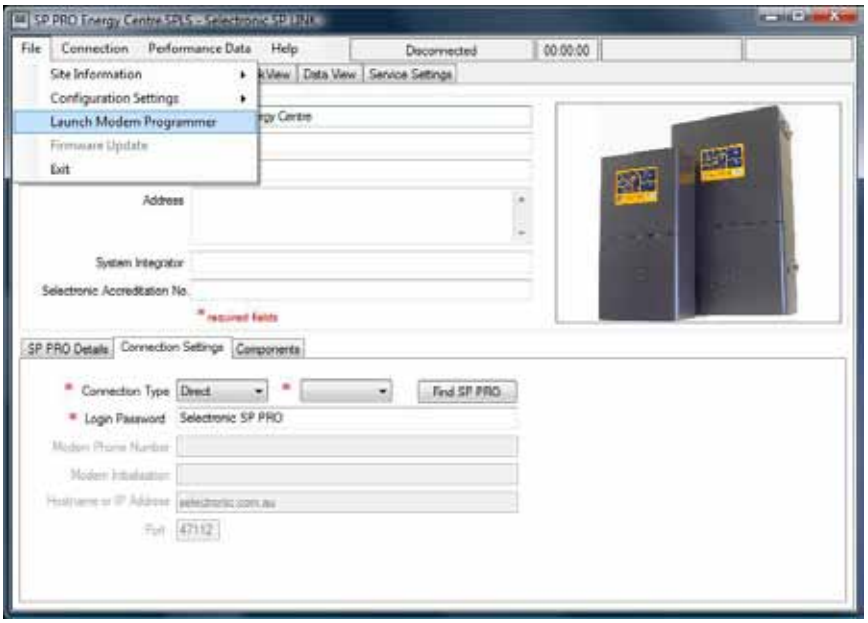
SP PRO Port 2 by default is set to 9600 baud which provides the most reliable connection for modems and Bluetooth connections. When set to RS485, the data rate for Port 2 is set automatically.

SP SYNC Setup

The SP PRO contains the SP SYNC interface on two RJ45 connections. This interface is automatically activated when the SP PRO System settings are set for Multiple Phase. Both connection points are the same and either or both can be used to link to the other SP PRO units in the Multiple Phase configuration.

SP PRO Modem Initialisation

You can initialise either a Netcomm V.92 modem or a Maxon “Next G” modem for use with the SP PRO using the Modem Programmer in the “File” drop down menu. This programs the modem so it can be connected to and work with the SP PRO. There is no need to program the modem connected to SP LINK at the local PC.



In the Modem Programmer window, Select the modem model, the PC COM port it is connected to, and the baud rate that the modem is to be programmed to. This baud rate must be the same baud rate of the SP PRO Serial Port it will connect to.

Installing for PRO Performance

Chapter Six

Many procedures covered in the INSTALLATION section of this manual have inherent risks. Whilst the SP PRO is designed to be safe, including safety features never before found in an inverter (such as Earth / Neutral bond monitoring), the fact remains that the voltages connected to or generated within the SP PRO are hazardous and potentially fatal. This very important point can never be stressed enough.

Preparation

The selection of a suitable site and good preparation is essential in getting optimum performance from the SP PRO.

SP PRO Inverter performance is dependant upon the environmental operating conditions, in particular ambient temperature and ventilation. In addition safety aspects must be considered, such as:

- Restrict access to authorised personnel only.
- Consideration of maintenance of ambient temperatures to ensure performance within product specification.
- Adequate ventilation, positioned away from heat producing devices and adhering to the minimum clearances required for adequate heat dissipation.
  Minimum 150 mm clearance from top, bottom and sides.
- In a covered location.
- Away from any explosive gas.
- Rodent Proof.
- Enough room to remove the cover.
- The provision of infrastructure for monitoring - example data cables

The SP PRO should be installed in a separate area to the battery system. The battery bank can emit explosive gas(hydrogen) and this must be vented outside and away from the SP PRO. The battery system should not be accessible by the user.

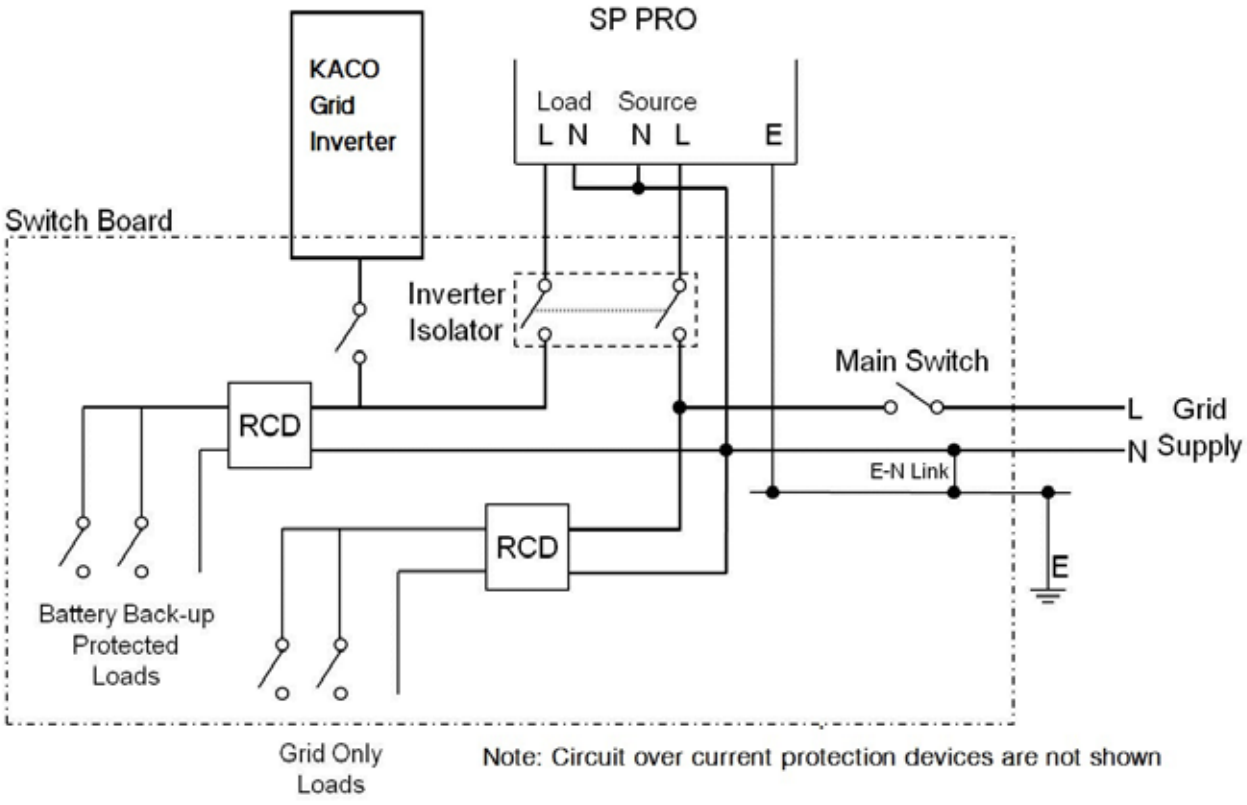
For Off-Grid and Solar Hybrid(On-Grid) applications it is recommended that the installation be in lockable area with a separating partition or enclosure for the battery bank.

Residual Current Device (RCD) Type Recommendation

The SP PRO produces a low distortion sine wave output via 50/60 Hz isolation transformer. This topology ensures that the output is sinusoidal and that their is no DC component associated with the SP PRO AC supply, whether that be feeding a domestic load or exporting solar to the grid. Standard Type AC RCDs are suitable for use with an SP PRO. Other types of RCDs may also be used with the SP PRO.

Solar Hybrid (On-Grid) Preparation

The intended application and use of the SP PRO must be well understood to allow the SP PRO to be appropriately connected to the installation. How the SP PRO is wired into the switchboard is dependant on whether all the installation's loads or only essential loads are to be supplied by the SP PRO for tariff optimization, self consumption or battery backup.



The following diagram shows AC wiring only and indicates the customer circuits; some of which are battery back-up protected, some are grid supply only.

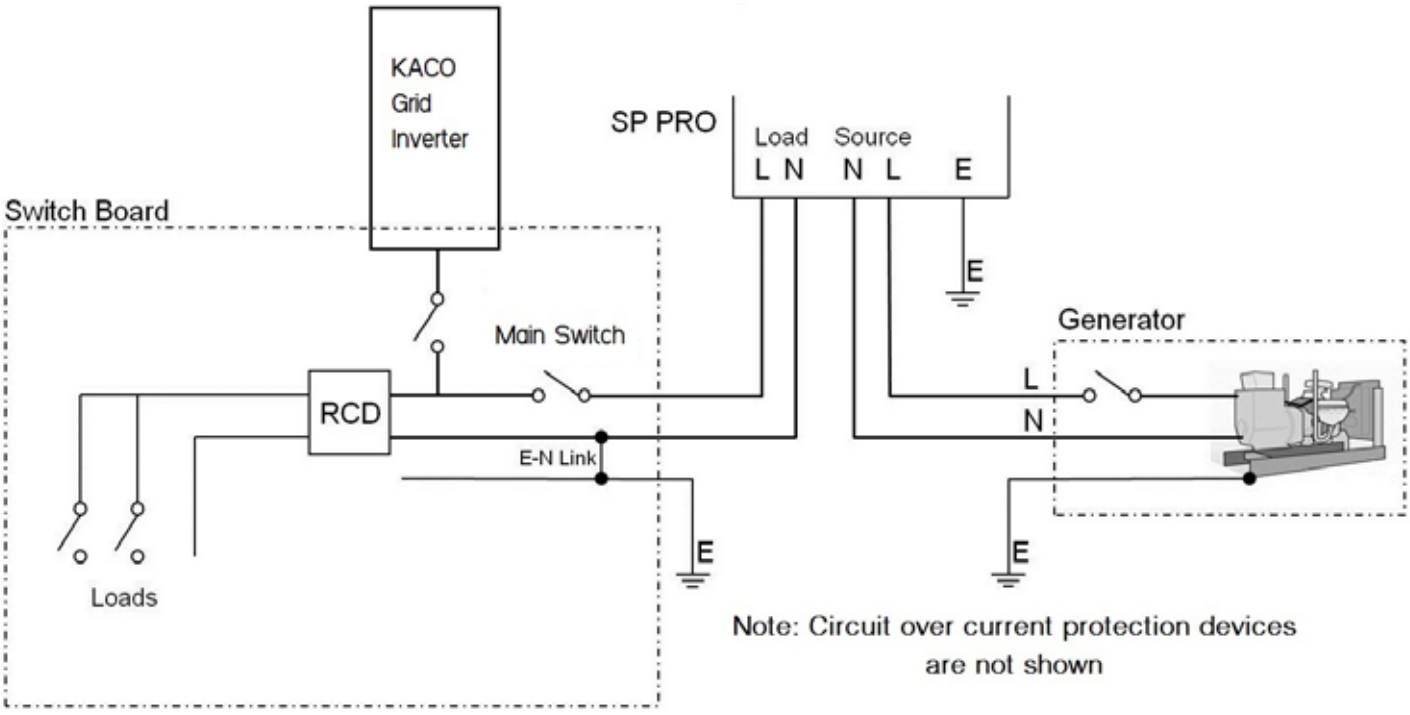
Attention must be paid to the Neutral conductor and connection through to the loads. The neutral conductor connecting to the loads must be maintained such that operation of the inverter isolator would not alter the bonding between Neutral and Earth.

The Neutral conductor must remain connected through to the loads and particular care should be taken with the placement of RCDs. These devices open both Active and Neutral conductors thus the SP PRO must be installed on the grid side of these devices.

Off Grid Preparation

The intended application and use of the SP PRO must be well understood to allow the SP PRO to be appropriately connected to the installation.

The following diagram shows AC wiring only and indicates the generator connection and feed into the Switchboard.



Mobile Preparation

When the SP PRO is to be installed in a mobile application (caravans, mobile homes and boats) the SP PRO must be configured such that the maximum current rating of the plugable connection (wiring and plug) to the AC Source is not exceeded.

For example, if the plugable connection for a caravan uses a 10 A rated lead and plug, the SP PRO must be configured appropriately via SP LINK to prevent the current from exceeding this rating. In SP LINK the Nominal AC Voltage may be set to 240 V and the Min AC Voltage tolerance may be set to -10% (216 V); then in SP LINK the AC Source Power must be set to no greater than 216 x 10 = 2160 W, or 2.16 kW.

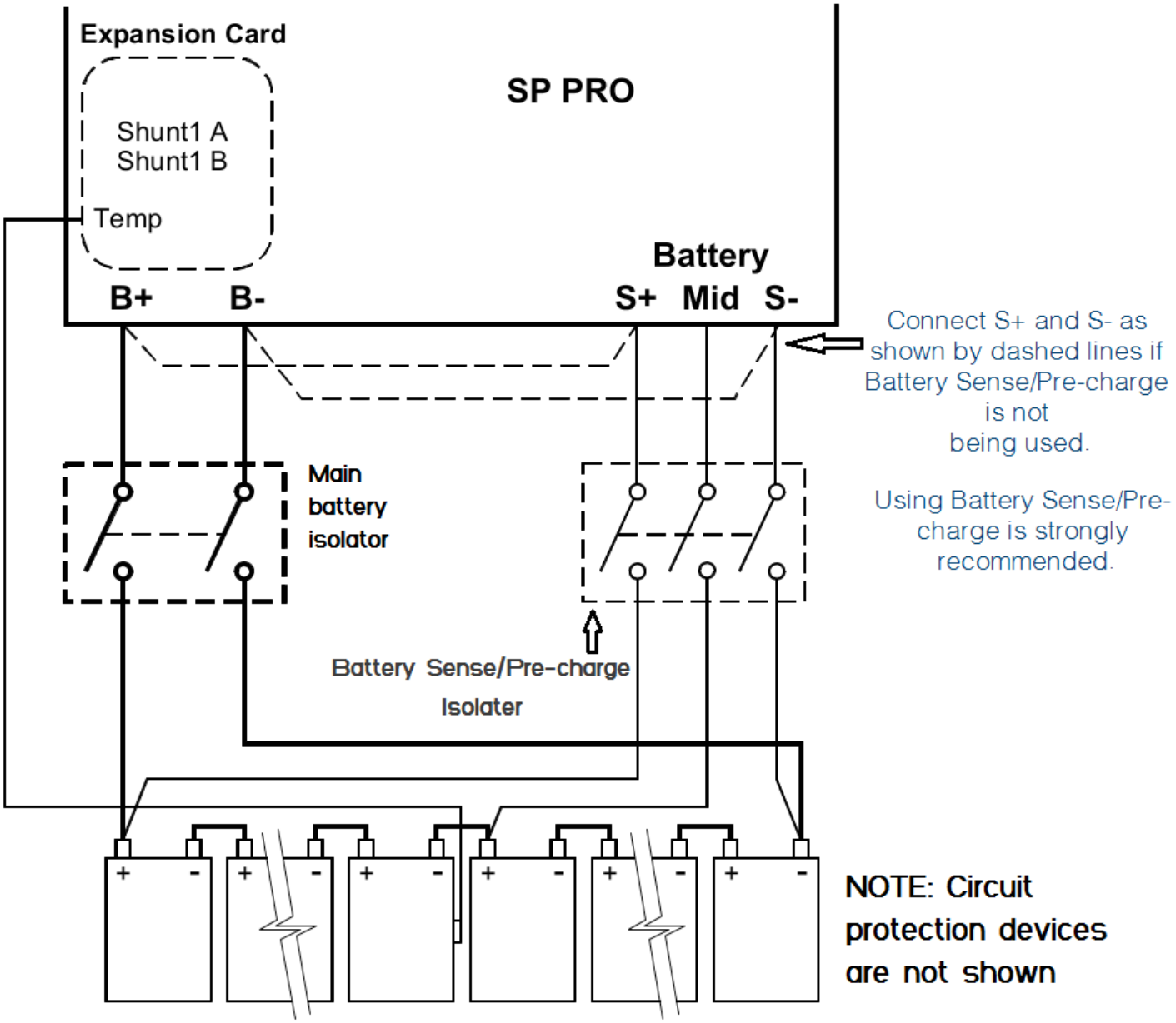
Multi Phase Preparation

For detailed information on preparing for a multi phase installation (in either a Solar Hybrid or Off grid application) please refer to the document “IN0016_xx 004573 SP PRO 3 Phase Installation” found on the USB stick supplied with this inverter or visit the support page on the Selectronic web found site at www.selectronic.com.au.

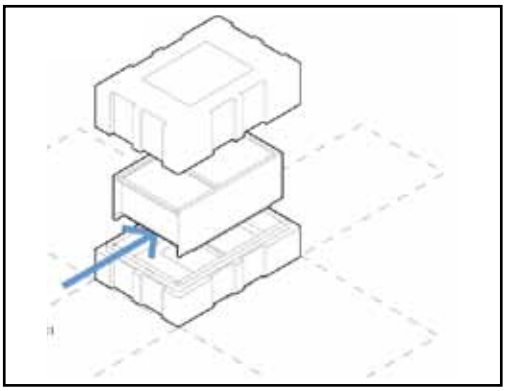
Battery Wiring Preparation

Battery wiring to the SP PRO is common, regardless of the application.

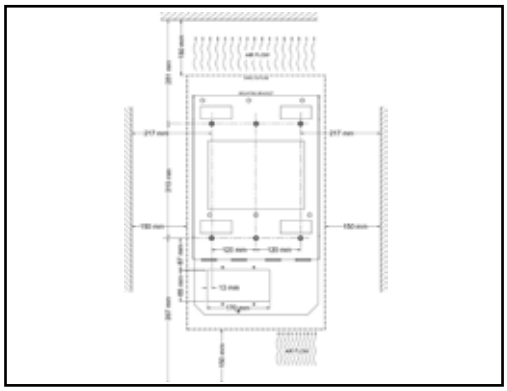
The below schematic diagram shows the main battery isolator, battery sense isolator and included temperature sensor.



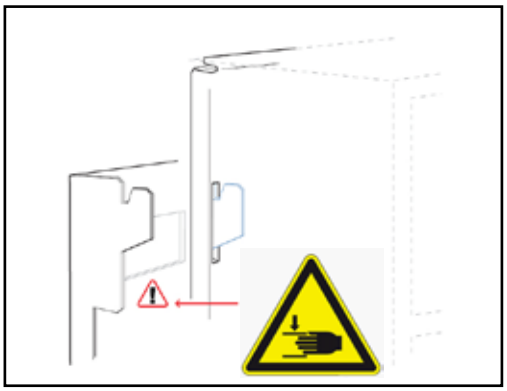
Installation of SPMC models



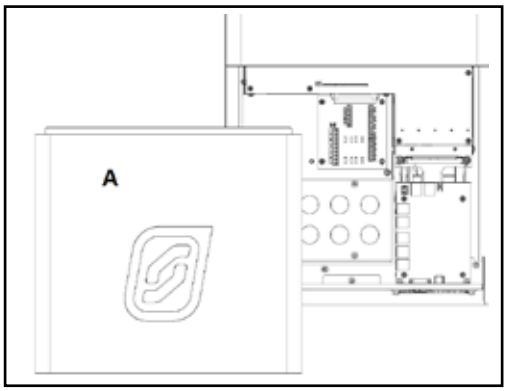
1 - Unpack the SP PRO onto a flat surface. When removing the SP PRO from its packaging carefully inspect for any damage that may have occurred in transit. Damage must be reported to your supplier immediately.



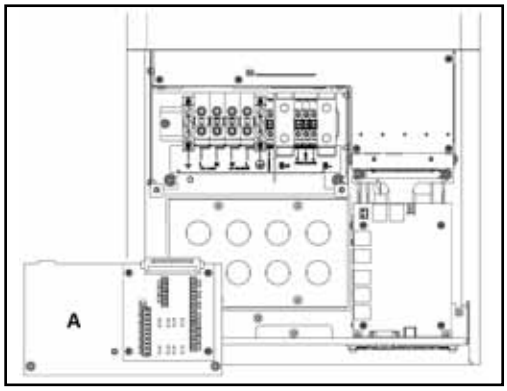
2 - Choose a suitable weight bearing and temperature resistant surface to mount the SP PRO. Max temperature is ambient +30 degrees C, max weight is 45 kg. The display of the SP PRO should be at eye level.
There should be no obstructions to the clear passage of air. Use the 6 x M8 holes to mount the bracket, if the SP PRO is being installed in a mobile situation use the optional mobile mounting bracket.



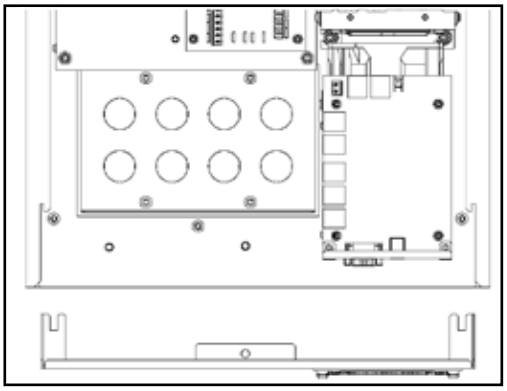
3 - Mount the SP PRO on the mounting plate by first hooking the top of the inverter over the projections on the mounting plate and lowering it into position. Care should be taken to observe Pinch Point warning. Secure the bottom of the SP PRO to the mounting plate with the transit bolt.



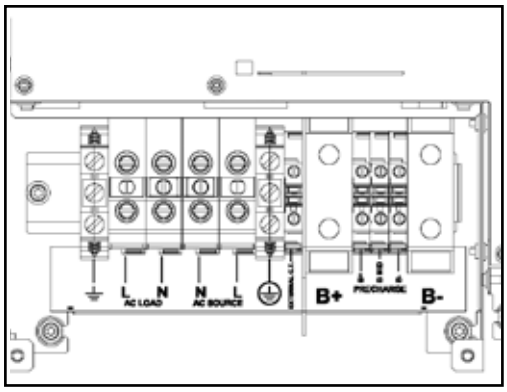
4 - Remove the cover plate(A) by unscrewing the two M5 Torx screws at the bottom of the SP PRO.



5 - Using the T15 torx driver remove the terminal cover and expansion card(A) by undoing the 2 screws.



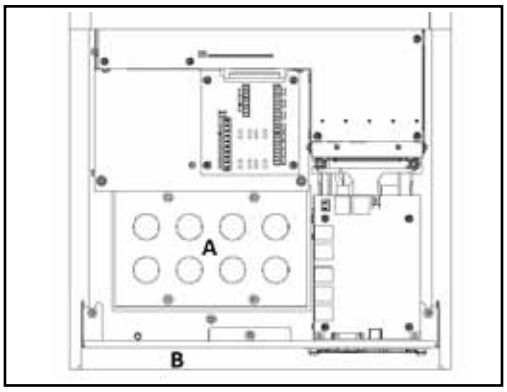
6 - The lower gland plate can be removed if required to give greater access to wiring terminals using T20 torx driver. NB, side screws need only be loosened.



7- Wiring must only be carried out by suitably qualified installers and must adhere to all relevant standards.

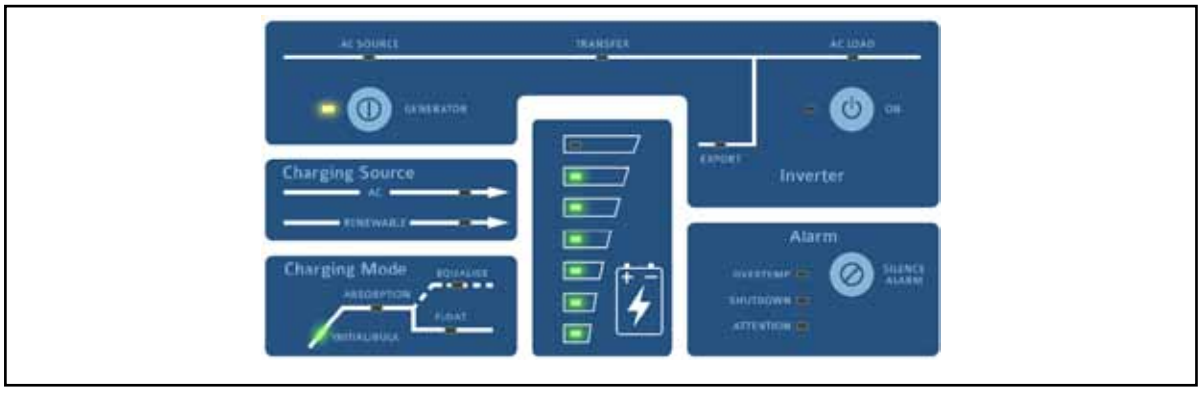
Detailed instruction for wiring the SP PRO are contained on the following pages. These MUST be followed before proceeding with installation.

Please bear in mind that installations performed and signed off by a Selectronic Accredited Integrator will benefit from additional warranty cover.



8 - Important points

- Failure to fill any holes in rear gland plate (A) or lower gland plate (B) will reduce IP rating and compromise thermal design.
- Installation of the included battery temperature sensor is imperative for the correct and accurate charging of your batteries.



9 - The SP PRO is ready to go.

Battery Cabling Requirements

Minimum Recommended Copper Battery Cable Sizes

Total distance of one conductor from the SP PRO to the battery terminals	Minimum Size Copper Battery Cables based on cable loss < 2% (V90 OR V-90HT INSULATION)				
	SPMC240	SPMC241	SPMC481	SPMC482	SPMC1201
< 2 m	50 mm^2	70 mm^2	50 mm^2	50 mm^2	35 mm^2
2 - 5 m	70 mm^2	50 mm^2 x 2	50 mm^2	70 mm^2	35 mm^2
5 - 10 m	N/A	N/A	70 mm^2	70 mm^2 x 2	50 mm^2
> 10 m	N/A - NOT RECOMMENDED				
Battery Sense/Pre-charge	1.0mm^2 or greater, double insulated (see note)				

V90 or V-90HT insulated cables are required to be spaced apart by at least the diameter of the cable. For cables with higher grade insulation, no spacing is required.

In a multi phase installation, the total battery cable rating is multiplied by the number of inverters in the system. For example in a three phase installation using three SPMC482 inverters, the minimum battery cable size with a length of 2m - 5m is 3 x 70 mm^2 or equivalent

Note: Battery Sense / Pre-charge cable MUST be robust with solid insulation. DO NOT USE CAT5 or equivalent cable.

Fusing

Recommended Battery Fuse Sizes

Product	SPMC240	SPMC241	SPMC481	SPMC482	SPMC1201
Battery Fuse Rating (A)	250	250	160	250	160
Battery Sense/Pre-charge	2A or greater (sized to protect wiring)				

The DC Breaking Capacity (normally specified in kA at a maximum DC voltage) of the fuse must be greater than the maximum DC Short Circuit current for the sites connect battery system.

Failure to follow these recommendations may lead to loss of power.

In a multi phase installation, the total battery fuse rating is multiplied by the number of inverters in the system. For example in a three phase installation using three SPMC482 inverters, the battery fuse size is 3 x 250A = 750A

DC Wiring

The SP PRO does NOT contain an internal fuse or DC breaker. The DC wiring must be fitted with appropriate fusing or circuit breakers.

The fuse or circuit breaker must be located in a user accessible position and be in close proximity to the battery system. The battery system must not be accessible by the user.

There are four DC wiring connections that should be made. B+ and B-, Battery Sense / Pre Charge and optional MID point monitoring. The battery sense / pre-charge connections can be made with light duty cable (1.0 mm^2 or greater).

DC wiring should be fed through the appropriate gland and terminated into the correct terminals. Connect the battery negative lead with the insulation stripped back 28 mm to the SP PROs Battery Negative screw terminal. Tighten the hex screw with the driver provided. Repeat the same process with the positive battery lead. Ensure that NO part of the wiring insulation is clamped in the SP PRO battery terminals.

Copper wiring must be used through out

Multiple Hazardous Energy Sources

DC wiring is fed from multiple sources including internal capacitors. Care must be taken to ensure that under no circumstances can the user access or touch wiring even after the operation of external circuit breakers or fuse assemblies.

AC Wiring

The SP PRO does NOT contain internal circuit breakers of fuses. The AC wiring MUST be fitted with appropriate fusing or circuit breakers.

The AC cabling should be sized according to maximum demand through (consumed by the AC Load) and simultaneously consumed by the SP PRO (consumed by the charging of batteries). The SP PRO is fitted with terminals which are suitable for accepting up to 35 mm^2 cables. The SP PRO is rated to 63 A current capacity and must be protected externally with circuit protection device(s) of no greater than 63 A.

AC wiring should be fed up through the appropriate gland and terminated to the SP PRO.
Connect the AC load wiring to the SP PRO: earth stripped back 16 mm to the AC Load earth terminal, neutral and active stripped back 12 mm to the AC Load terminals. Connect the AC source wiring to the SP PRO: earth to the AC Source earth terminal, neutral and active to the AC Source terminals.

Copper wiring must be used though out.

Multiple Hazardous Energy Sources

AC wiring is fed from multiple sources. Care must be taken to ensure that under no circumstances can the user access or touch wiring even after opening all circuit breakers.

Earth Wiring

The inverter shall be earthed to the installations Earth system. A minimum copper earthing conductor of 6 mm^2 shall be used. See your local regulations for further information on earthing conductor size.

Earth the inverter by connecting earth wiring from the switchboard to the inverter Earth terminal. The SP PRO is suitable for Multiple Earth Neutral systems.

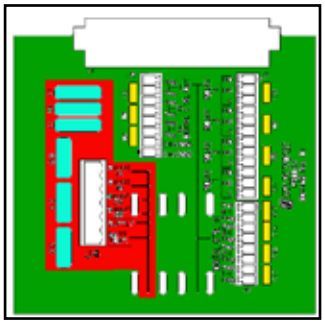
Copper wiring must be used through out.

SPMC1201 Expansion Card Warning

SPMC1201 models - Hazardous Voltage - 120 V Battery

Expansion card connects to both Hazardous and Safety Extra Low Voltage (SELV) wiring. The connector and wiring to J4 (marked in RED) MUST be treated as Hazardous and be physically segregated from other wiring connected to expansion card.

Protective cover MUST be installed on the Expansion card.



Current Shunt Wiring

SPMC1201 models - Hazardous Voltage - 120 V Battery

Current shunts connections are both internally and externally connected to battery negative terminal and MUST be treated as Hazardous. Double insulated sense cabling MUST be used.

DC Shunts MUST be installed into the battery negative lead. Ensure that the shunt ONLY measures the renewable or other DC load current and not any current feeding to or from the inverter.

The sense wires for the externals shunts should be fed up through the appropriate gland and terminated to the SP PRO expansion card. The sense cabling should be kept as short as possible. “CAT5” type cabling or any multi conductor multi strand cable is suitable for shunt sense wiring. Remember that these small cables are connected to battery negative and an inadvertent short circuit with either lead to battery positive would short circuit the battery bank. It is recommended that both these wires be fused.

The polarity of these shunt sense leads is not important if they are configured to either “Load” or any of the input selections, such as “Solar”; however polarity is important when using the shunt in “Dual” mode – that is where the shunt is used for both input and output measurement to obtain a nett result.

In “Dual” mode, the sense leads must be connected correctly – expansion card shunt terminal 1A or 2A to the solar and load side, 1B or 2B to the battery negative side.

Battery Temperature Sensor

SPMC1201 models - Hazardous Voltage - 120 V Battery

Battery temperature sensor is internally connected to battery negative terminal and MUST be treated as Hazardous. Sensor cable is double insulated.

The battery temperature sensor is pre-wired to the expansion card and must be installed in thermal contact with the centre of a side of a battery and insulated from external temperature effects for accurate charging. If the cable provided is not long enough it may be extended. Polarity of the cable is not important.

Generator Control Wiring

Generator control wiring should be fed up through the appropriate gland and terminated to the SP PRO Expansion card. The minimum required is one pair of wires for a generator run signal which must be wired to one of the four relay outputs. “CAT5” type cabling or any multi conductor multi strand cable is suitable for all control wiring. The Expansion Card can be plugged in and out of the SP PRO for ease of wiring.

Serial Port Connection

The communication cable can be attached to either the USB or DB9 connections on the lower panel.

Gland Plate Fitout

To maintain the IP rating and safety approval of the SP PRO, all gland plate holes must be completely filled. Gland plates supplied with the SP PRO have “knock outs” for your convenience. Please do not “knock out” any unused gland holes and ensure all used holes have gland nuts (supplied) fitted.

Initial Start up Procedure

Before turning on the SP PRO double check all connections, paying particular attention to correct polarity. Give each cable a firm tug to ensure it is securely fitted. If satisfied everything is well, attach the terminal cover plate and insert and secure the expansion card.

SPMC1201 models - Protective cover MUST be installed on Expansion card.

Connect the battery sense / pre charge wires and wait until all indicators are lit and stable.

Connect battery cables

Press ON button (long press > 1 second) once. The AC Load indicator will be steady blue. You can now start to use your SP PRO and switch on external AC circuit breakers.

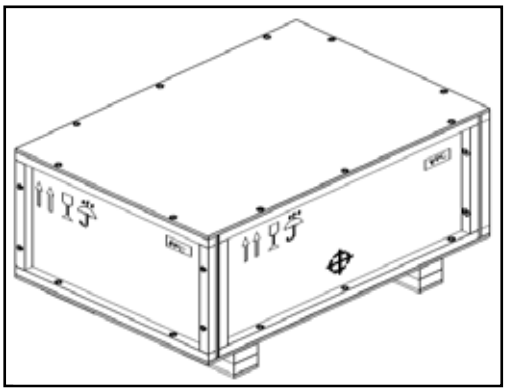
Replace cover and secure with two screws from below.

Labelling

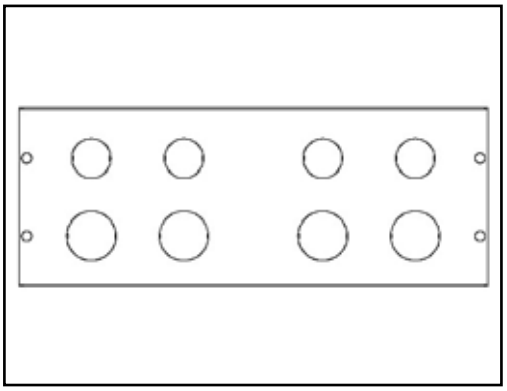
Regulations mandate the application of warning and control labels to the various circuit breakers, isolators and switch boards in the installation.

The SP PRO in Solar Hybrid(On Grid) installations behaves like a UPS and will continue to provide power to the load upon interruption of mains supply. Warning signs must indicate which circuits or switchboards operate in this manner.

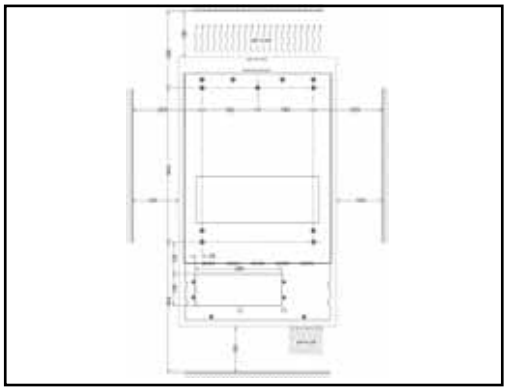
Installation of SPLC models



1 - Undo ten bolts ($^{7}/_{16}$") to remove lid. Cardboard tray contains mounting plate, rear air outlet mesh cover and all documentation. Inspect for damage in transit and report any to your supplier immediately.

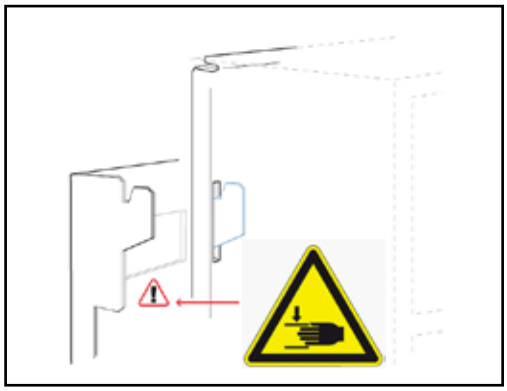


2 - Cable entry is either from below or wall entry. Gland plates are inter changeable . Gland plates secure to the underside of unit base or to the inside of the mounting plate using four T10 Torx screws.

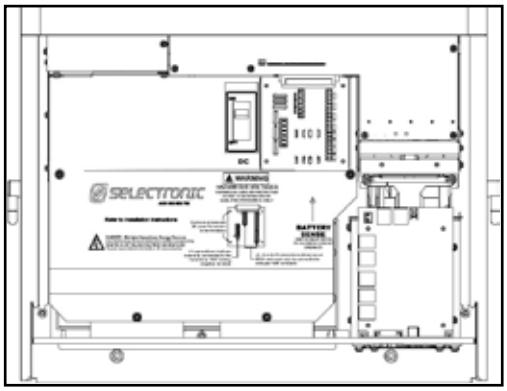


3 - Choose a suitable weight bearing and temperature resistant surface to install the mounting plate. Max temperature is ambient +30°C, weight is 115 kg. The plate should be mounted at a convenient level.
There should be no obstructions to the clear passage of air.
Wall or cavity cables may now be fitted through gland plate.

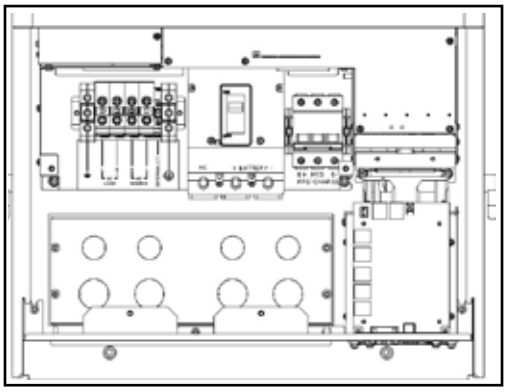
4 - Undo 10 bolts ($^{7}/_{16}$") to remove sides from the packing base. Undo 8 bolts ($^{7}/_{16}$") to remove clamps from handles
HEAVY: Take care when lifting - 105 kg
SHARP: Use gloves - handle edges sharp.
TOP HEAVY: Secure unit when standing unit upright.
Stand unit upright using handles.
REAR AIR OUTLET MESH COVER: Fit and secure with six thumb screws



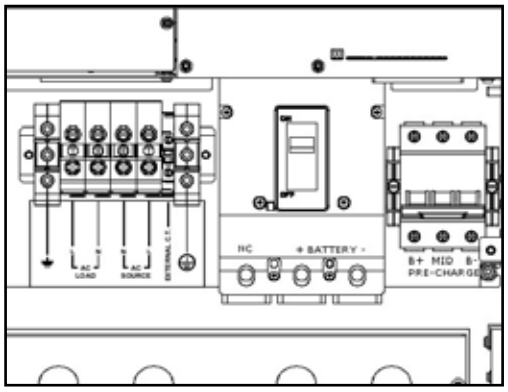
5 - Mount the SP PRO on the mounting plate by first hooking the top of the inverter over the projections on the mounting plate and lowering it into position. Care should be taken to observe Pinch Point warning. Secure the bottom of the inverter to the mounting plate with two M6 bolts provided.



6 - Remove the cover plate by unscrewing two screws at the bottom of the SP PRO. Expansion card remains secured to SP PRO.



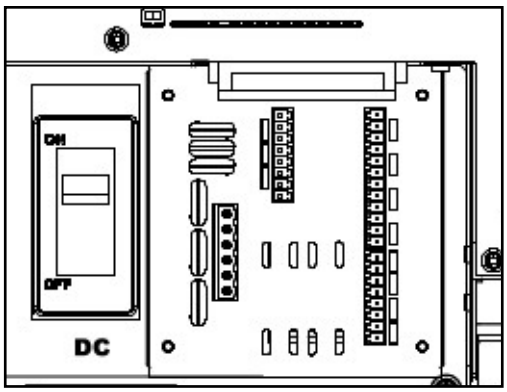
7- Undo five T10 Torx screws to remove terminal plate.
Note: Gland plate shown in wall entry cable position.
Expansion card not shown for clarity.



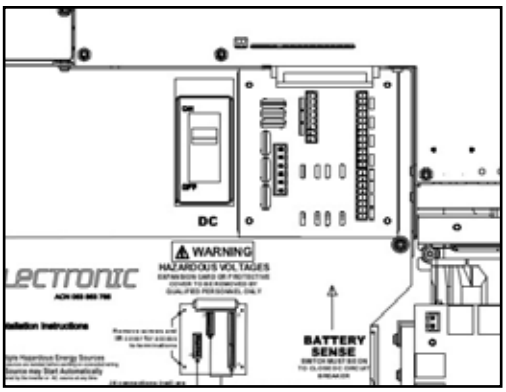
8 - Wiring can only be carried out by suitably qualified installers and must adhere to all relevant standards.

Installations performed and signed off by a Selectronic Accredited Integrator will benefit from an additional warranty cover.

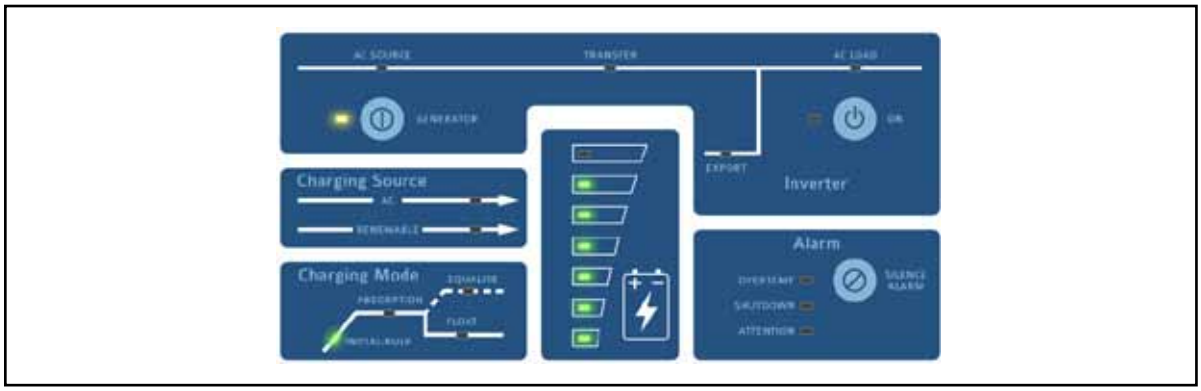
9 - STOP: Detailed instruction for wiring SP PRO contained on the following pages. These MUST be followed before proceeding with installation.



10 - Important points
- Failure to fill any holes in the gland plates will compromise IP rating and the thermal design.
- Protective cover on Expansion Card MUST be fitted.
- Installation of the battery temperature sensor is imperative for the correct and accurate charging of your batteries.



11 - Initial Switch On.
- Verify all connections are tight and correct polarity.
- Battery Sense switch (under Expansion Card) must be closed and pre charge complete before DC Breaker will close.



12 - The SP PRO is ready to go.

Battery Cabling Requirements

Minimum Recommended Copper Battery Cable Sizes

Total distance of one conductor from the SP PRO to the battery terminals	Minimum Size Copper Battery Cables based on cable loss < 2% (V90 OR V-90HT INSULATION)
	SPLC1202
< 5 m	50 mm^2
5 - 10 m	70 mm^2
> 10 m	NOT RECOMMENDED
Battery Sense/Pre-charge	1.0mm^2 or greater. Double insulated (See note)

V90 or V-90HT insulated cables are required to be spaced apart by at least the diameter of the cable. For cables with higher grade insulation, no spacing is required.
The maximum temperature rating of the cabling within the unit needs to be considered.
Maximum temperature with cabling space is ambient +30 degrees C.

In a multi phase installation, the total battery cable rating is multiplied by the number of inverters in the system. For example in a three phase installation using three SPLC1202 inverters, the minimum battery cable size with a length of 5m - 10m is 3 x 70 mm^2 or equivalent

Note: Battery Sense / Pre-charge cable MUST be robust with solid insulation. DO NOT USE CAT5 or equivalent cable.

Primary DC Terminal Connections

M8 copper lugs are required to connect battery wiring into the SP PRO. 70 mm^2 lugs may need to be reduced in width to fit within circuit breaker terminal.

Fusing

Recommended Battery Fuse Sizes

Product	SPLC1202
Battery Fuse Rating (A)	250
Battery Sense/Pre-charge	2A or greater (sized to protect wiring)

The DC Breaking Capacity (normally specified in kA at a maximum DC voltage) of the fuse must be greater than the maximum potential DC Short Circuit current for the battery system.

Failure to follow these recommendations may lead to loss of power.

In a multi phase installation, the total battery fuse rating is multiplied by the number of inverters in the system. For example in a three phase installation using three SPLC1202 inverters, the battery fuse rating is 3 x 250A = 750A.

DC Wiring

The SP PRO contains a 250 A DC circuit breaker and a low current Battery Sense / Pre charge DC switch. It may be necessary to fit additional fusing or circuit breakers to protect the battery system. Any additional fuse or circuit breaker must be located in a user accessible position and be in close proximity to the battery system. The battery system is hazardous and must not be accessible by the user.

DC wiring should be fed through the appropriate gland and terminated to the correct terminals.

Battery B+ and B- connections. Connect the battery negative lead using M8 copper lug to the SP PROs B- terminal. Tighten the hex screw including load washer with the 6 mm Allen key such that load washer flattens. Repeat the same process with the positive battery lead. The terminal labelled “NC” provides no internal connection.

Battery Sense / Pre charge B+ and B- and optional MID connections. These connections can be made with light duty cable (1.0 mm^2 or greater) - cable MUST be double insulated. Connect the battery negative lead with the insulation stripped back 12 mm to the SP PROs Pre charge negative screw terminal. Repeat the same process with the positive battery lead and optional mid point lead.

Copper wiring must be used through out.

Multiple Hazardous Energy and Voltage Sources - 120 V Battery

DC wiring is fed from multiple sources including internal capacitors. Care must be taken to ensure that under no circumstances can the user access or touch wiring even after the operation of external circuit breakers or fuses assemblies.

AC Wiring

The AC cabling should be sized according to maximum demand through (consumed by the AC Load) and consumed by the SP PRO (consumed by the charging of batteries). The SP PRO is fitted with terminals which are suitable for accepting up to 50 mm^2 cables. The SP PRO is rated to 125 A current capacity and must be protected externally with circuit protection device(s) of no greater than 125 A.

AC wiring should be fed through the appropriate gland and terminated to the SP PRO.
Connect the AC load wiring to the SP PRO: earth to the load earth terminal (strip length 18 mm), neutral to the load neutral terminal (strip length 18 mm), and active to the Load Circuit Breaker (strip length 15 mm).
Connect the AC source wiring to the SP PRO.

Copper wiring must be used though out.

Multiple Hazardous Energy and Voltage Sources

AC wiring is fed from multiple sources. Care must be taken to ensure that under no circumstances can the user access or touch wiring even after the operation of external circuit breakers.

Earth Wiring

The inverter shall be earthed to the installations Earth system. A minimum copper earthing conductor of 16 mm^2 shall be used. See your local regulations for further information on earthing conductor size.

Earth the inverter by connecting earth wiring from the switchboard to the inverter Earth terminal. The SP PRO is suitable for Multiple Earth Neutral systems.

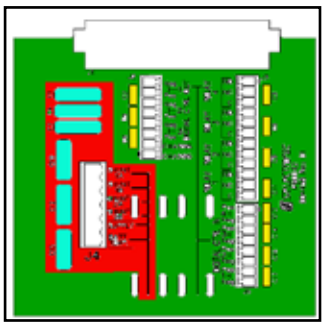
Copper wiring must be used through out.

Expansion Card Warning

Hazardous Voltage - 120 V Battery

Expansion card connects to both Hazardous and Safety Extra Low Voltage (SELV) wiring. The connector and wiring to J4 (marked in RED) MUST be treated as Hazardous and be physically segregated from other wiring connected to expansion card.

Protective cover MUST be installed on the Expansion card.



Current Shunt Wiring

Hazardous Voltage - 120 V Battery

Current shunts connections are both internally and externally connected to battery negative terminal and MUST be treated as Hazardous. Double insulated sense cabling MUST be used.

DC Shunts MUST be installed into the battery negative lead. Ensure that the shunt ONLY measures the renewable or other DC load current and not any current feeding to or from the inverter.

The sense wires for the externals shunts should be fed through the appropriate gland and terminated to the removable terminal block on the SP PRO expansion card. The sense cabling should be kept as short as possible. Remember that these small cables are connected to battery negative and an inadvertent short circuit with either lead to battery positive would short circuit the battery bank. It is recommended that both these wires be fused. Fuses should be a sand filed type with suitable DC breaking capacity.

The polarity of these shunt leads is not important if they are set to either “Load” or any of the input selections, such as “Solar”; however polarity is important when using the shunt in “Dual” mode – that is where the shunt is used for both input and output measurement to obtain a nett result.

In “Dual” mode, the sense leads must be connected correctly – expansion card shunt terminal 1A or 2A to the solar and load side, 1B or 2B to the battery negative side.

Battery Temperature Sensor

Hazardous Voltage - 120 V Battery

Battery temperature sensor is internally connected to battery negative terminal and MUST be treated as Hazardous. Sensor cable is double insulated.

The battery temperature sensor is pre-wired to the expansion card and must be installed in thermal contact with the centre of a side of a battery and insulated from external temperature effects for accurate charging. If the cable provided is not long enough it may be extended. Polarity of the cable is not important.

Generator Control Wiring

Generator control wiring should be fed up through the appropriate gland and terminated to the SP PRO Expansion card. The minimum required is one pair of wires for a generator run signal which must be wired to one of the four relay outputs. “CAT5” type cabling or any multi conductor multi strand cable is suitable for all control wiring. The Expansion Card can be plugged in and out of the SP PRO for ease of wiring.

Serial Port Connection

The communication cable can be attached to either the USB or DB9 connections on the lower panel. Serial communication connections are galvanically isolated from the battery.

Gland Plate Fitout

To maintain the IP rating and safety approval of the SP PRO, all gland plate holes must be completely filled. Gland plates supplied with the SP PRO have “knock outs” for your convenience. Please do not “knock out” any unused gland holes and ensure all used holes have gland nuts (supplied) fitted..

Initial Start up Procedure

Before turning on the SP PRO double check all connections, paying particular attention to correct polarity. Give each cable a firm tug to ensure it is securely fitted. If satisfied everything is well, attach the terminal cover plate.

Protective cover MUST be installed on Expansion card.

Switch battery feed on to the battery sense / pre charge and the main battery connection. Close Battery Sense / Pre charge switch - under the expansion card - and wait until all indicators are lit and stable.

DC Circuit Breaker will not close until pre charge is complete.

Close DC Circuit Breaker.

Press ON button (long press > 1 second) once, AC Load indicator will be steady blue.
You can now start to use your SP PRO by turning on external AC circuit breakers.

Replace top cover and secure with two screws.

Labelling

Regulations mandate the application of warning and control labels to the various circuit breakers, isolators and switch boards in the installation.

The SP PRO in Solar Hybrid(On Grid) installations behaves like a UPS and will continue to provide power to the load upon interruption of mains supply. Warning signs must indicate which circuits or switchboards operate in this manner.

Using SP LINK

Chapter Seven

Overview

"SP LINK is the pathway to the real power of your SP PRO"

SP PRO is really many products in one. You can simply unpack the unit, mount it on a wall, connect the appropriate cables – and you've got power using the following default settings;

- Off Grid
- AC Source size is equal to the power output of the SP PRO model you are using
- Sealed Batteries
- No State of Charge readings, voltage only.

To go further and unlock the true power of the SP PRO unit, you will need to load the SP LINK software (found on the supplied USB stick) onto your PC computer. We strongly suggest these steps are done before heading to the installation site.

This section of the SP PRO manual is an exsert from the SP LINK manual. For detailed information on SP LINK, please consult the SP LINK manual found in the HELP menu within SP LINK.

System Requirements for SP LINK

The system requirements include:

PERFORMANCE REQUIREMENTS:

- Microsoft Windows XP SP3 / Vista / 7 / 8 (not RT). Other operating systems not supported.
- 30 MB hard disk space
- If Microsoft .NET 4.0 Framework is not already installed then approx. 850 MB of additional disk space will be required.
- Adobe Reader - 100 MB hard disk space
- 1 GHz Pentium or faster processor.
- 512 MB RAM
- USB Port

PERFORMANCE VIEWER REQUIREMENTS

- Microsoft Office 2003 or later

SP PRO Firmware Version 7.0 onwards

This SP LINK manual details configuration parameters and options found in SP PRO firmware version 7.0 onwards. Some parameters are no longer supported and are not detailed within this manual. Please refer to prior SP LINK manual for details of unsupported features.

SP LINK is fully backward compatible with all prior versions of SP PRO firmware.

Getting Started with SP LINK

You will find SP LINK and other helpful documents contained on the USB stick supplied with your SP PRO. It is good practise to check at www.selectronic.com.au/sppro/splink.htm for the latest version of SP LINK.

After installing SP LINK onto your computer you can begin to use SP LINK. However, we do warn that to achieve the best result from your system, configuration should be done by an experienced system designer. For maximum warranty in Australia, you will need to employ the services of an SP PRO Accredited Integrator. For full warranty terms and conditions please see the warranty supplied with your SP PRO inverter.

To get started you do not have to be connected to an SP PRO inverter. Once you have installed SP LINK onto your computer you are able to pre-configure and store the site information and SP PRO configuration setting. These are then ready to transfer to the SP PRO inverter after it is installed.

When you first open SP LINK, the Splash screen will appear. Once SP LINK has loaded, the screen will disappear. Click “Hide the screen on startup” to prevent the splash screen from displaying in the future. .

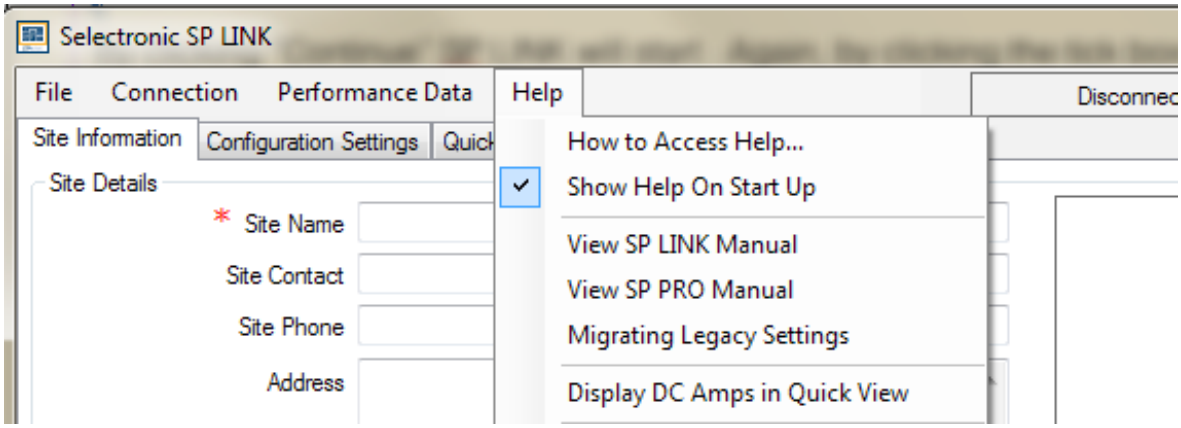
HELP!

You will see the How to Access Help guide.

By clicking “Continue” SP LINK will start. Again, clicking the tick box “Don’t show me this screen again” will prevent this from being displayed in the future.

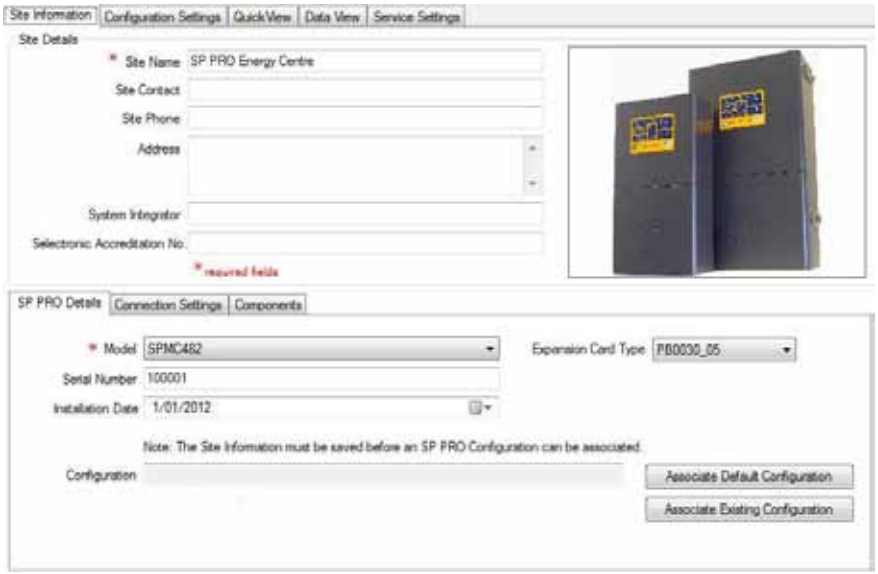
When working with SP LINK you may require a refresher course on the function of some of the settings or hints about the function of a screen. Simply RIGHT CLICK MOST HEADINGS and tabs and a pdf copy of the SP LINK manual will appear on the right hand side of your screen displaying the relevant section.

You can also access both the SP PRO manual(this document) and SP LINK manual from the Help menu at any time.



Preparing a new site

SP LINK will open in the Site Information tab, you will need to enter information in the mandatory fields (with red stars) including information under the “SP PRO details” tab It is not possible to proceed without setting up and saving a site file.



Remember to right click any heading or tab for more information.

There is a large window on the right side of the Site Information page, click on this to place a photo of the system in the site file. This may help in recalling details of the system at a later date. You may also wish to put a picture of the customer here.

It is also helpful to place photos of the various system components under the “Components” tab to assist in the future system maintenance.

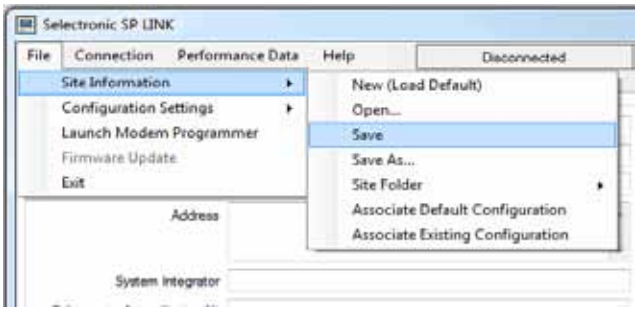
Under the Connection settings tab you will need to select the Connection Type method to connect to the SP PRO. If you are simply going to plug your computer into the SP PRO then select Direct.

LOGIN PASSWORD
A LOGIN PASSWORD is required for connecting to the SP PRO. SP LINK can only connect through to the SP PRO with the correct password. The default password is “Selectronic SP PRO”. This is different to the setting passcode.

The LOGIN PASSWORD only needs to be changed if you wish to prevent any connection to the SP PRO. This is particularly important to secure the SP PRO against unauthorised monitoring or modification when the SP PRO is remotely accessible via a Modem or Network connection type. Once connected, the default password may be changed under Service Settings - See SP LINK Manual for details.

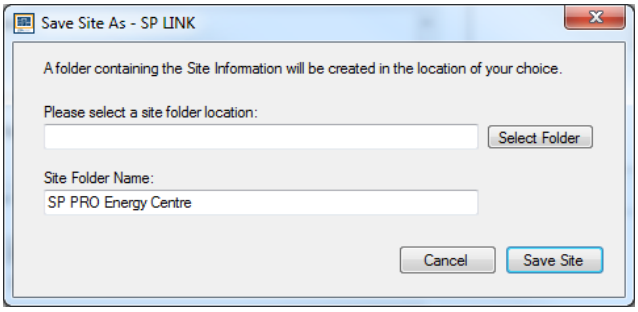
Saving a new site

All site information must now be saved.



To save the SP PRO site information, click on File - Site Information - Save.

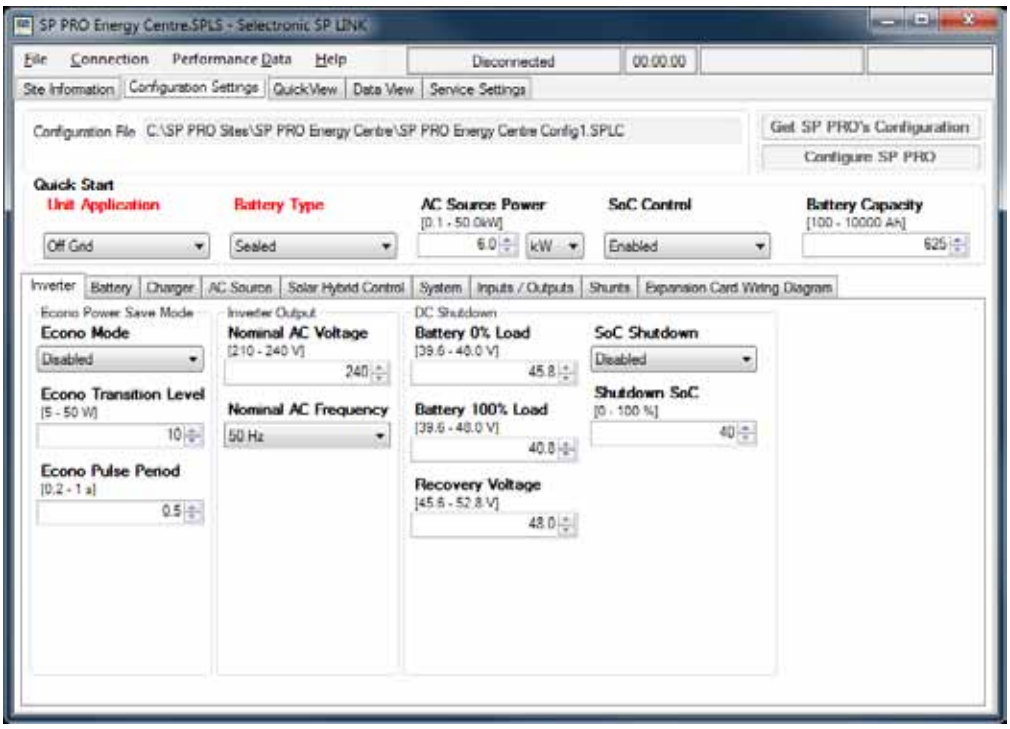
As this is a new site you will need to choose a common place on your computer to store the site folder. Other information about this site such as Performance Downloads and Configuration settings will automatically be placed in this folder. The folder will have the same name as the site. Site files will be named with a .SPLS extension.


Save Site As - SP LINK
A folder containing the Site Information will be created in the location of your choice.
Please select a site folder location:
Select Folder
Site Folder Name:
SP PRO Energy Centre
Cancel
Save Site

Preparing a new configuration

You can now start to prepare your Configuration. The SP PRO configuration is stored in a file within the site file and contains all of the SP PRO settings for transferring into the SP PRO. This can be done after you connect SP LINK to the SP PRO (see “Connecting to your SP PRO”).

Click on the Configuration settings tab.



The SP PRO is a very advanced and intelligent product but don’t let the large number of settings concern you.

The default configuration settings have been carefully considered and will be adequate in most circumstances. The Flooded and Sealed lead acid battery defaults provide safe and efficient charging for most common batteries.

There is a Quick Start section near the top of the page which contains the settings that need to be considered for all applications.

The following table indicates the setting needed to be considered for each system.

QUICK START - SETTINGS NEEDED FOR ALL SYSTEMS		
SETTING	CONFIGURATION TAB	COMMENTS
Unit Application	Quick Start	Set to Off Grid, On Grid (Solar Hybrid) or Mobile
Battery Type	Quick Start	Set default battery voltage operating range
AC Source	Quick Start	Maximum capacity of grid supply or AC generator
SoC Control	Quick Start	Enable for battery State of Charge (SoC) management
Battery Capacity	Quick Start	Amount of connected battery storage

The following tables have a minimal list of settings to consider for each particular application.

SOLAR HYBRID (ON GRID) GRID BACKUP SETTINGS

SETTING	CONFIGURATION TAB	COMMENTS
AC Source Disconnect Alarm	System	Enable to alert users that system is running on battery supply
SoC Shutdown	Inverter	The grid backup battery limit point
Periodic Recharge	Battery	Recharge self discharge losses in batteries held in Float for long period of time.

SOLAR HYBRID (ON GRID) GRID BACKUP PLUS SOLAR SETTINGS

SETTING	CONFIGURATION TAB	COMMENTS
AC Source Disconnect Alarm	System	Enable to alert users that system is running on battery supply
SoC Shutdown	Inverter	The grid backup battery limit point
Periodic Recharge	Battery	Recharge self discharge losses in batteries held in Float for long period of time.
Shunt Name and Limits	Shunts	For DC Coupled Solar
KACO Link and Number	System	For Managed KACO AC Coupled solar

SOLAR HYBRID (ON GRID) TARIFF OPTIMIZATION SETTINGS

SETTING	CONFIGURATION TAB	COMMENTS
Shunt Name and Limits	Shunts	For DC Coupled Solar
KACO Link and Number	System	For Managed KACO AC Coupled solar
Grid Input and Export plus Support and Charge Limits	Solar Hybrid Control	The times and limits of grid supply and battery SoC usage

OFF GRID SETTINGS

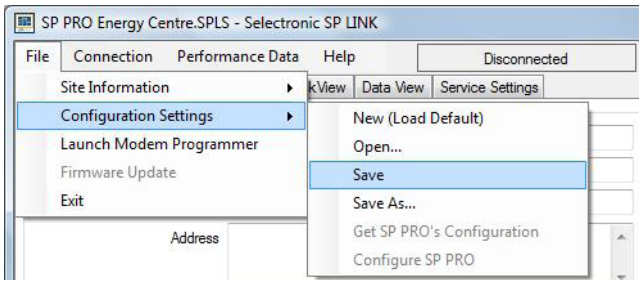
SETTING	CONFIGURATION TAB	COMMENTS
Shunt Name and Limits	Shunts	For DC Coupled Solar
KACO Link and Number	System	For Managed KACO AC Coupled solar
Generator Controller	AC Source - Generator Controller	Disable if manual start generator

For detailed information on all Configuration Settings, please refer to the SP LINK manual.

Saving a new configuration

Your configuration settings should now be saved to file before sending them to the SP PRO.

To save the SP PRO configuration settings, click on File - Configuration Settings - Save.

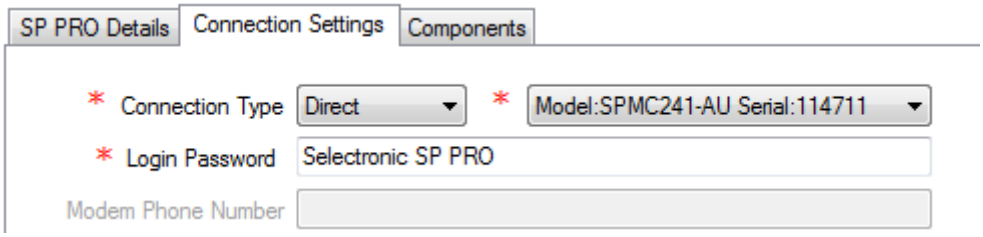


The configuration settings will be saved in the same location as the site information saved in the previous step. SP LINK will automatically use the default file name Config1 prefixed with the site name.

The configuration settings are now stored on your computer. The SP PRO can be configured with these settings at any time once the computer is linked and connected to the SP PRO.

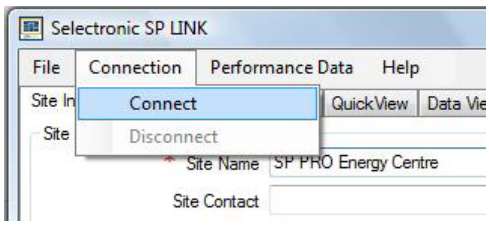
Connecting to your SP PRO

Plug the SP PRO into your computer with the supplied USB cable. The SP PRO will be automatically detected by your computer and SP LINK. Please wait until this has occurred and will be indicated within SP LINK showing both model and serial number under Connection Settings.



Now you can connect to the SP PRO.

Click the “Connect” button under connection settings or in the Connection menu, click Connect.



Now SP LINK is connected through to the SP PRO. SP LINK will notify you if a connection is unable to be established.

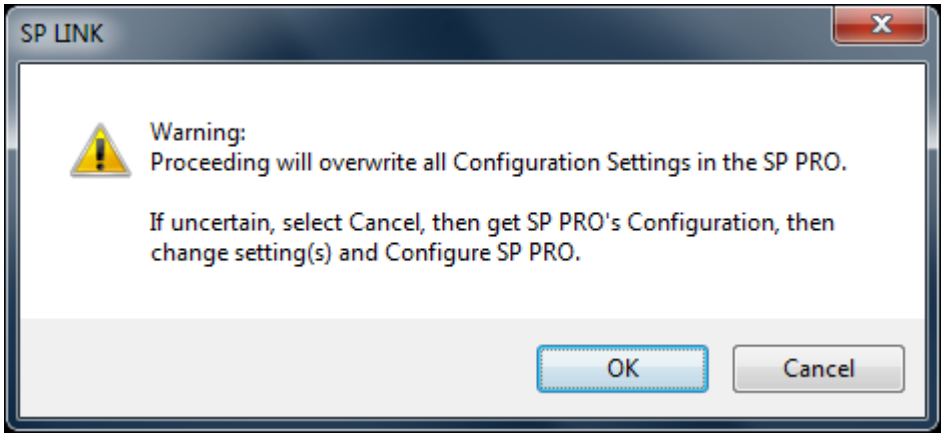
It is important to note that at this stage the SP PRO has NOT been configured with any of the setting changes that you have made. The settings displayed are only on the computer at this point and have not been copied into the SP PRO. This is performed in the next step.

SP LINK will notify you if the SP PRO you are connected to is NOT as detailed in the SP PRO Details. SP LINK will also, if required, prompt you to update the time within the SP PRO from the computers time.

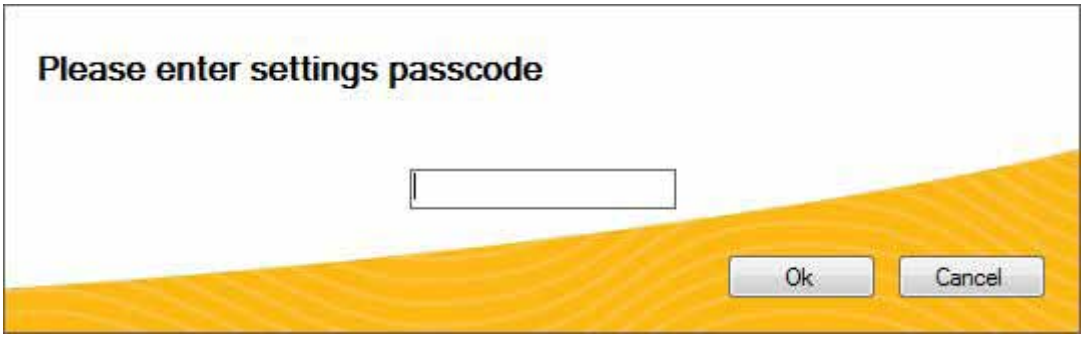
Configuring your SP PRO

With SP LINK connected to the SP PRO, Click Configure SP PRO from the File - Configuration Settings menu or from the Configuration Setting page.

SP LINK will - unless “Get SP PROs Configuration” has just been performed - warn that all settings will be overwritten.


SP LINK
Warning:
Proceeding will overwrite all Configuration Settings in the SP PRO.
If uncertain, select Cancel, then get SP PRO's Configuration, then change setting(s) and Configure SP PRO.
OK
Cancel

For security purposes, to ensure no-one can tamper with your SP PRO, you will now be asked to enter your passcode.



The default passcode is 74, however you can alter this if you wish. See Service Settings in SP LINK manual.

Once you have entered your passcode click “OK”

SP LINK will verify passcode and configure the SP PRO with these changes.

SP LINK will indicate if for any reason the Configuration was unsuccessful.

You have now transferred all the Configuration Settings shown in SP LINK into your SP PRO. The settings take immediate effect.

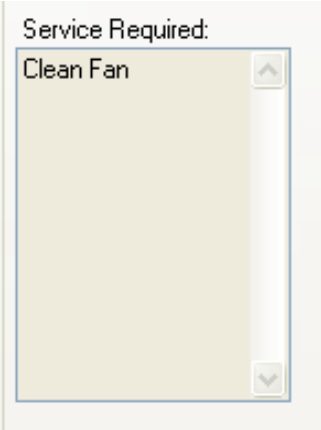
Service and Maintenance

Chapter Eight

If fan filter cleaning is required:

1. Ensure fan is stationary
2. Remove the four retaining screws that hold the fan filter in place.
3. Clean the filter mesh with a soft brush or similar implement.
4. Replace filter and tighten the four retaining screws.

All other maintenance on your SP PRO should be performed by a Selectronic Accredited Integrator.



Above the fan filter is a safety grill. Do not remove this grill – fast moving fan blades can cause injury

Monitoring the Operation of your SP PRO

The following items should be monitored on a regular basis:

- BATTERY VOLTAGE - this should NEVER be below the nominal system voltage - 24 V, 48 V or 120 V
- BATTERY SoC% - a high average figure will maintain good battery life
- The AVERAGE DAILY ENERGY SUPPLIED to the load (Load kWh/Day) is not exceeding the designed system daily load.
- PERFORMANCE DATA EVENTS.

Maintenance of your SP PRO

Very little is required in order to maintain your SP PRO, however following the steps below will ensure smooth operation of the system.

- Cleaning. Large particles of dirt can be removed with a soft brush or similar implement. Dust can be removed with a damp cloth. Solvents, abrasives or corrosive chemicals must not be used for cleaning.
- When the fan filter requires cleaning the Attention indicator will illuminate. Check in the NOW tab of the DATA VIEW section to determine what type of service is required.

All other maintenance on your SP PRO should be performed by a Selectronic Accredited Integrator.

Changing Configuration Settings

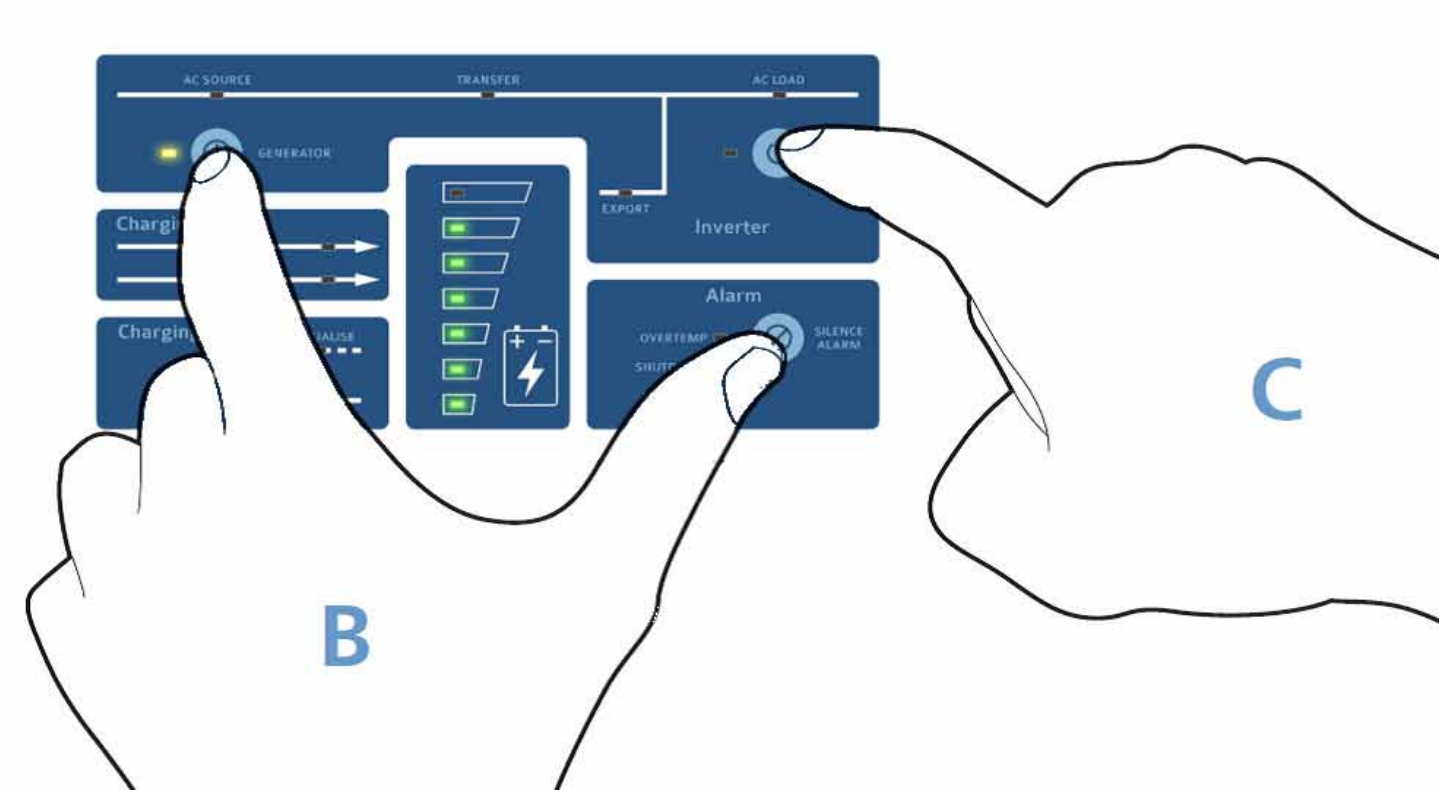
The following is recommended when adjusting system settings:

- Save existing configuration file
- Change the minimum set of parameters at any one time then check for expected results.
- Save new configuration file.

Restoring to Factory Default settings

The following procedure will restore factory defaults - Off Grid, Voltage Control mode - with the choice of either flooded or sealed battery voltage defaults.

- Set SP PRO in Idle mode with a long press of the ON button (AC Load Indicator OFF)
- Press and hold buttons B as shown, all indicators will go off.
- Whilst continuing to hold B, press C to select from following options -
  Green = Flooded batteries
  Red = Sealed batteries
  Off = Factory default settings will NOT be restored and with no change to any setting
- Release all buttons, wait 10 seconds until display is stable.



- Factory Defaults as selected have been restored.

System Shutdown

Your integrator will provide detailed Shutdown and Restart instructions specific to your installation.

Operating When the Generator is offline

If the generator is not available (maybe due to maintenance or breakdown) then the following recommendations should be followed to conserve energy:

- Turn on Econo Mode. The SP PRO will pulse the output voltage and only supply continuous voltage when the load exceeds a defined limit. If present, renewable energy will recharge the battery.
- SWITCH OFF THE SP PRO when ever possible to reduce the load on the battery, allowing the battery to be recharged even by small renewable power.
- IF THE BATTERY BECOMES HEAVILY DISCHARGED, the SP PRO will automatically stop supplying AC power to the load, to prevent battery degradation or damage. Switching on the Low Battery Override function will restore power for a time at the expense of discharging the battery even more deeply.

Note: The SP PRO internal electronics are powered from the DC (battery) side, not from the AC (generator) side. Therefore if the battery is excessively discharged, the electronics may not be able to start up until the battery is partially recharged, from renewable power for example.

Installer Maintenance

Other than ensuring all AC and DC connections are always tight, there are only three areas that may require maintenance.

- FAN ALERT – This can be checked in the “Now” tab of the “Data View” section. A fan alert generally indicates that the fan is stationary when it should be running. This will mean that either the fan needs replacement or that a foreign body is stuck in the fan. Either situation is unlikely as the SP PRO is protected against pest infestation and the fan life monitor should predict fan failure.
- FAN LIFE is recorded in the “Technical Data” section of the “Data View” tab (see below). Fan life is expressed in the percentage of fan life used i.e. The figure starts at 0% and rises the longer the fan runs. As fan life is projected to be in excess of 40,000 hours quite a high percentage of fan life can be used before replacement is necessary.
- CAPACITOR LIFE is measured on both halves of the power module and is expressed, as before, in percentage of life used. The power module should be replaced when capacitor life, in either half, reaches 95%.

There are no user serviceable or replaceable parts within your SP PRO. Any maintenance, other than fan filter cleaning, should be performed by a Selectronic Authorised Integrator.

System Maintenance

Your Selectronic Accredited Integrator will advise you of the maintenance required for the balance of your system components.

Troubleshooting

Chapter Nine

Service and Support

In the event that you require support or have questions regarding the operation of your SP PRO, please contact your Accredited Integrator. Your Accredited Integrator has direct knowledge of the system components, the load profile and SP PRO configuration which affect the behaviour and operation of the SP PRO. Accredited Integrators have been trained in the operation of the SP PRO and the configuration of the units to meet the requirements of each installation.

The SP PRO contains a very large amount of Performance Data to allow troubleshooting of any system or inverter issues, most are NOT an inverter failure. If your power system is not functioning as required then your system designer should review the Performance Data stored within the SP PRO. See the Using SP LINK and Performance Monitoring section within the SP LINK manual for further information. Using the Performance Data Viewer within SP LINK, every aspect of the system and SP PRO can be analysed. If required, Selectronic can provide a second opinion (charges may apply) of the Performance Data.

If ATTENTION indicator is on or flashing then connect to the SP PRO with SP LINK and check the “Attention Required” panel in the Data View - Now section. Here you will find in plain English the reason for the Attention indicator. See the Performance Monitoring section in the SP LINK for further information. You can also refer to Controls and Indicators section for indicator meaning.

Further information can be found at www.selectronic.com.au/support

General

If the system is not operating correctly, perform a general check as follows:

- Check if the front panel "Alarm" indicators show a problem, and take the recommended action as described in "Attention Required" section of the "Now" tab of "Data View".
- Switch the SP PRO to Idle via the push button for a few seconds then back on. If this does not restore normal operation, check the Performance Data Events for a cause.

Off Grid Generator Start/Stop Problems

Daily patterns of generator operation will change as the load supplied each day changes and as any renewable input such as solar increases or decreases from day to day or season to season. Using SP LINK check the "Generator Running Reason" section of the "Now" tab of the "Data View" section.

If the reason does not seem to relate to what is actually happening in your system consult your Selectronic Authorised Integrator.

IF THE GENERATOR RUNS MORE OFTEN THAN NORMAL OR EXPECTED:
There are several possible causes:

1. The system average load has increased:
Using SP LINK check the "7 DAY DAILY AVERAGE" figure in the "AC LOAD ENERGY" section of "AC HISTORY" within the "DATA VIEW" tab and compare it with the value displayed when the system was operating satisfactorily.
Using SP LINK compare the "7 DAY DAILY AVERAGE" figure in the "AC LOAD ENERGY" section of "AC HISTORY" within the "DATA VIEW" tab against the system design value which should have been supplied by the installer.
If loads have significantly increased, identify any new electrical equipment that has been added

2. The system peak loads are very high:
Using SP LINK check the POWER and the POWER (5 MIN AVERAGE) in the AC SOURCE area in the NOW tab of the DATA VIEW section while operating any new appliance that has been added to the system. The associated On 5 Load power and the On 15 minute load power setting in the GENERATOR AUTO RUN TAB may need adjustment by your integrator.

3. The load during late night and early morning periods is higher than expected but not high enough to keep the generator running permanently. There may be multiple starts and stops as the battery becomes discharged and is partly recharged:
Increase the generator minimum run time to increase the amount of battery recharge before stopping, hence reducing the number of starts and stops.

4. The battery is not operating correctly.
If the generator runs longer than normal or expected:
This is generally because system load has increased or the renewable input from solar has decreased. It could also be because the battery efficiency has fallen off with age or cell failure in the battery.
Use the Performance Data Events to establish load levels and reasons for generator starts and stops.
Use the Data View menu to check measured values, particularly the accumulated battery energy in and energy out totals. These will have to be compared over a week to see the change in the accumulated values.

The SP PRO may be performing an Equalise charge which can take some hours to complete; check if the Equalise indicator is illuminated.

There may be a sustained load on the system. Check to see that appliances have not been left on. The Now, Today and AC History sections of the Data View tab provide information regarding the load power.
Check the generator schedule settings.

If the generator restarts a minute or so after it last stops then the battery is discharged, the battery volts are low, or a load is present. Check the Now section of Data view to see the Generator Running Reason. You can shut the generator down permanently by setting the generator to NOT available, or Generator Controller to Disabled.

Inverter Start/Shutdown Problems

SP PRO WILL NOT START

If the indicators remain dark when the SP PRO is switched on it is likely that DC power is not present. Check that the main battery fuse is closed. Retry the procedure, if it continues to fail contact your supplier for further instructions.
If the SP PRO starts with the Shutdown indicator illuminated, check the reason in the Attention Required window in the Now tab in Data View area of SP LINK. Record the reason indicated and contact your supplier for further instructions.

SP PRO SHUTS DOWN

Whenever the SP PRO shuts down, it attempts to restart periodically.
The SP PRO shuts down automatically for the following conditions, which should be investigated:

- Overload
- DC over-voltage and under-voltage
- Excessive battery discharge
- Over-temperature

Check if the SP PRO front panel Shutdown indicator is illuminated and check the reason in the Attention Required window in the Now tab in Data View area of SP LINK, record the reason indicated and contact your supplier for further instructions.

AC Power Problems

If the power fluctuates, lights go bright or dim but don't go out.

- Check the SP PRO front panel indicators and Performance data for information on the cause.
- The generator output may be varying due to poor generator condition or switching on and off heavy loads. Check the generator voltage reading via SP LINK.
- The SP PRO output may be varying due to starting very heavy loads. Check the output voltage reading (AC Load Voltage) via SP LINK.

If the power goes off for short periods (1 second to a few minutes)

- Check the SP PRO front panel indicators and Performance Data for information on the cause.
- The SP PRO may be in Power Save mode and the load is too small to detect. In this mode the SP PRO pulses the output until a load is detected. Check the Econo Power Level in SP LINK.
- The SP PRO may be shutting down due to overload or low DC voltage and periodically attempting restarts. If the SP PRO is shutting down switch off any heavy loads that may be causing the shut down. If the SP PRO is shutting down due to low DC voltage, check generator availability and reasons for the generator not starting such as flat start battery or no fuel

If the power goes off for longer periods (10 minutes to many hours)

- Check the SP PRO front panel indicators and Performance Data for information on the cause.
- Check the Attention Required window in the Now tab in Data View section of SP LINK to see if a fault is indicated and contact your supplier for further instructions.

Battery Problems

Batteries are very dangerous. Please read the safety information provided by the battery supplier.

Battery does not charge properly

- Check that the battery charging requirements are correctly set up in the SP PRO.
- Check that the solar regulator is correctly set up.
- Check all cables and connections to the batteries.

If the solar does not appear to be doing much, the solar regulator may be set too low. Check indicators and DC History in SP LINK.

If the battery is not operating correctly:

- Physically inspect the battery and check for loose connections. Monitor the battery voltage as heavy loads supplied by the SP PRO are turned on and off.
- Check the voltage on each battery making up the battery bank to see if there are cells not fully charged or not accepting charge. Measure voltages on each cell/battery at different times in the charge discharge cycle. Just after charge has started say after 10 minutes, in mid charge, just before end of charge, ten minutes after discharge starts, mid discharge and just before recharge starts.

Solar Hybrid (On Grid) Problems

GRID AVAILABLE BUT I LOOSE POWER

- The likely cause is the SP PRO has disconnected form the grid due to high voltage or frequency, leaving the site to operate from the limited battery storage. To resolve, widen the “Sync Tolerance” parameters or contact the electricity supplier.

DC COUPLED SOLAR SYSTEM THAT DOESN’T EXPORT AS EXPECTED

- The likely cause is the Solar Controller (external device to the SP PRO) is restricting the flow of power from the PV array. To resolve, make sure the Solar Controller float charging set point is ~ 1 V higher than the SP PRO Float stage set point.

Appendix A Specifications

Appendix

Standards Compliance

AS62040.1.1-2003	Uninterruptible power systems (UPS) - General and safety requirements for UPS used in operator access areas
AS/NZS 61000-6-3:2007	Electromagnetic Compatibility (EMC) - Part 6-3: Generic Standards - Emission Standard For Residential, Commercial And Light-industrial Environments
AS/NZS 61000-6-4:2007	Electromagnetic Compatibility (EMC) - Part 6-4: Generic Standards - Emission Standard For Industry
AS 4777.2-2005	Grid connection of energy systems via inverters - Inverter requirements
AS 4777.3-2005	Grid connection of energy systems via inverters - Grid protection requirements

C-tick Australia

Product Specifications

Note: Selectronic reserve the right to change specifications without notice.
All ratings are at 25°C and nominal battery voltage unless otherwise stated. The product is specified to a maximum altitude of 2000 metres.

SP PRO SERIES SPECIFICATIONS		SPMC240	SPMC241	SPMC481	SPMC482	SPMC1201	SPLC1202
Nominal batter voltage		24 V	24 V	48 V	48 V	120 V	120 V
Continuous, output power Continuous, charge current	@ 25°C	3,000 W 125 A	4,500 W 188 A	5,000 W 104 A	7,500 W 156 A	7,500 W 63 A	20,000 W 166 A
Continuous grid export power		rated output					
20 second load rating 20 second output current	@ 40°C	7,500 W 28 A	10,500 W 40 A	12,000 W 47 A	18,000 W 70 A	18,000 W 70 A	44,000 W 180 A
1 minute output power	@ 40°C	5,400 W	7,600 W	8,700 W	13,000 W	13,000 W	30,000 W
60 minute output power	@ 40°C	3,200 W	4,700 W	5,300 W	8,000 W	8,000 W	24,000 W
DC input voltage range		20 - 34 V	20 - 34 V	40 - 68 V	40 - 68 V	100 - 170 V	100 - 170 V
TRANSFER SWITCH (Synchronous)							
AC transfer current capacity		63 A					125 A
Max AC input source, (generator/grid)		15 kVA					30 kVA
Max total output to Load, AC source + inverter		15 kVA					30 kVA
AC transfer time		no-break					
If grid fails		0 - 0.03 seconds					
Battery charger type		Temperature compensated, 5 stage, power factor corrected with dual stage float					
EFFICIENCY							
DC consumption idle		6 W					
DC consumption standby (Econo Mode)		12 - 20 W				n/a	
ON with no load		25 W	33 W	35 W	43 W	43 W	90 W
Peak efficiency – all modes		95%	95%	95.5%	96%	96.5%	97.4%
10% load		90%	90.5%	91%	91%	91.5%	94.8%
20% load		92.5%	93%	94%	94%	94%	96.8.1%
50% load		94%	94.5%	95%	95.5%	96%	97%
100% load		90%	91%	92.5%	93%	93.5%	95.5%
AC OUTPUT (standalone)							
Range		210 to 240 V +/- 0.5%					
Regulation		<1% droop 0-100% rated load (<2% @ 150%, <5% @200%)					
THD		<3% @ 0-200% rated load					
Frequency		50 or 60 Hz +/-0.005% standalone					
AC SOURCE (input)							
Nominal voltage		240 V~					
AC current (Recharge, Bypass & Normal modes)		63 A					125 A
Tolerance on nominal voltage		Configurable 204 to 264 V~					
Nominal input frequency		50/60 Hz					
Tolerance on nominal frequency		Configurable +/- 1% to 10%					
Generator can be started by		Battery SoC, DC voltage, battery load, unit temperature, time & remote control					
FEATURES							
Battery temperature sensor		Included					
Mid point battery voltage sensing		Included					
Front panel display and controls		22 x LED indicators with auto adjusting intensity. Display indicates, charger status, remaining usable battery capacity, alarms, AC status. AC status indicators powered from AC voltage. Generator control button. On button. Silence Alarm button.					
Digital Inputs		4 of: Max 60 V DC (Active > +10 V, Inactive < +3 V)					
Shunt Inputs		2 of: +/-75 mV, adjustable 25 A to 500 A					
Analogue Inputs		2 general purpose logged 0-60 V				n/a	
Relay Outputs		4 of: 60 V, 500 mA					
Digital outputs		3 of: 60 V, 5 mA					
Communication ports		USB and RS232 (optional Wireless and Ethernet)					
Memory retention of settings & data		Permanent					
SP LINK configuration and monitoring software		Standard, allows configuration of parameters and monitoring of parameters and SP PRO display remotely.					
Dimensions (mounted) W x H x D		375 x 690 x 220					540 x 870 x 290
Weight		29 kg	34 kg	35 kg	40 kg	40 kg	115 kg
Standards		IEC 62040-1-1:2002 / AS 62040.1.1-2003 with CB certificate (except SPMC1201)					
		AS/NZS 61000-6-3 2007				AS/NZS 61000-6-4 2007	
Grid Protection		AS 4777.2 2005 and AS 4777.3 2005					
Protection		IP43					

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